This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

**Usage guidelines**

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

**About Google Book Search**

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

War 138.76

HARVARD COLLEGE
LIBRARY

VE RI
TAS

THE GIFT OF
CHARLES SHEPARD LEE
Class of 1910

W[illegible]16

HARVARD COLLEGE
LIBRARY

VE RI
TAS

THE GIFT OF
CHARLES SHEPARD LEE
Class of 1910

# A
# MILITARY DICTIONARY,

COMPRISING

TERMS, SCIENTIFIC AND OTHERWISE, CONNECTED
WITH THE SCIENCE OF WAR.

COMPILED BY

MAJOR-GENERAL G. E. VOYLE,
RETIRED ROYAL (BENGAL) ARTILLERY, AUTHOR OF THE 'GUNNER'S AID.'

ASSISTED BY

CAPTAIN G. DE SAINT-CLAIR-STEVENSON, F.R.G.S.
ANCIEN OFFICIER D'ÉTAT-MAJOR AUXILIAIRE.

" What is obvious is not always known, and what is known is not
always present."—JOHNSON.

*THIRD EDITION.*

DEDICATED BY PERMISSION TO H.R.H. THE DUKE OF CAMBRIDGE.

LONDON:
WILLIAM CLOWES & SONS, 13 CHARING CROSS.
1876.

War 138.76

HARVARD
UNIVERSITY
LIBRARY
OCT 21 1963

LONDON:
PRINTED BY WILLIAM CLOWES AND SONS,
STAMFORD STREET AND CHARING CROSS.

# PREFACE.

In bringing out a new edition of my Dictionary, I have kept in view the object I had originally in its compilation—the production of a general work of reference—and as such I now offer it to all who take an interest in military affairs.

The number of expensive books to which the military student must have recourse, in order to obtain the varied information required in the different branches of the service, struck me some years ago as being a source of great inconvenience. To avoid this, I considered it advisable to bring out a work, by condensing into one volume all that is indispensable, as well as much with which it is desirable an officer should become acquainted.

This Dictionary, which passed through two editions, was published in India some years ago.* But in these days of rapid and constant transition, not only in the *matériel* of an army, but also in drill, organisation, and tactics, when new inventions are continually brought forward and introduced into the service, it is difficult without a work of this character to acquire the knowledge of these changes. A new edition of the Dictionary was therefore thought necessary, and that book, revised, corrected, and greatly enlarged, is now offered to the public.

Matter foreign to the British army has been introduced in this edition, so as to enable the military student to compare the organisation, arms, &c. of continental armies with those of his own service. The Dictionary contains also descriptions of ancient armour, and of arms, lately in the service, which have become obsolete, as it may be of some interest to follow the changes which have taken place in the mode and means of fighting from the earliest period down to the present time.

The insertion of veterinary terms and of remedies for the common complaints of horses will, I hope, be found useful under conditions where a veterinary surgeon is not available, as is often the case in detached parties of cavalry in India and elsewhere.

---

* 'A Dictionary of Artillery and other Military and Scientific Terms,' compiled by Colonel Voyle, R.A., second edition. (Calcutta: Thacker, Spink, and Co.)

A description of certain tools and machines found commonly in workshops may prove acceptable to departmental officers on their first joining government manufacturing establishments.

The meaning of a few Hindustani words, not strictly military, is given for the use of officers on first going to India.

In conclusion, I beg to acknowledge the valuable help obtained from the works of many authors, both military and scientific, and the assistance I have received from various friends, and especially from the officer whose name appears with mine on the title-page. To avoid crowding up the text, I have not inserted after each quotation the name of the author from whom my information has been derived; but a list of all works which I have consulted, and from which I have extracted, will be found at the commencement of the work.

It is intended, with the view of meeting the changes which are likely to take place in the *matériel* of the army, to issue a supplement yearly, containing all alterations and additions.

G. E. V.

# LIST OF WORKS CONSULTED OR EXTRACTED FROM.

Aide-Mémoire to the Military Sciences.
Aide-Mémoire de l'Officier d'État-Major, par M. de Rouvre, Lieutenant-Colonel d'État-Major.
Ammunition, Treatise on, 1874. Published by authority.
Almanach de Gotha, 1876.
Archives, German Military.
Army Circulars. Published by the War Office.
Art of War, by Lieutenant-Colonel Graham.
Artillerist's Manual, 11th edition, by Major Griffiths, R.A.
Artillerist's Handbook of Reference, by Lieutenants G. Well, R.A., and J. C. Dalton, R.A.
Artillery, Dictionary of, by General Cotty.
Artillery Exercises, Field, Changes in, in 1873, by Major-General Phillpotts, R.H.A.
Artillery Institution Papers.
Artillery, Lectures on, by Majors Owen and Dames, R.A.
Artillery, Modern, by Lieutenant-Colonel Owen, R.A.
Artillery, Treatise on, by Lieutenant-Colonel Boxer, R.A.
Astronomical Atlas, by Milner.
Baker's Elements of Mechanism.
Balfour's Encyclopædia of India.
Blue Books (Parliamentary).
Bourne on the Steam Engine.
Brande and Cox's Dictionary of Science, Literature, and Art, 1875.
Cape's Mathematics.
Cavalry Manual, by Colonel Ainslie.
Chambers's Encyclopædia.
Change of Matériel. Published by the War Office.
Chemistry as applied to the Arts and Manufactures, by Dr. S. Muspratt.
Chemistry, Handbook of, by Abel and Bloxam.
Chemistry, Manual of, by Dr. O'Shaughnessy.
Conférences du Ministre de la Guerre (France).
Conférences Militaires Belges.
Construction of Dwelling-houses.
Defence of Military Outposts, by Captain Jebb, R.E.
Dictionary, Handy, of Military Terms, by Captain W. Knollys.
Dictionary, Military and Naval, by Colonel Burn.
Dictionary, Military and Naval, by James.

Dictionary of Arts and Sciences, by E. Francis, F.L.S.
Dictionary of the English Language, by Johnson.
Dictionary of the English Language, by Webster.
Dictionary of the English Language, by Hyde Clark, LL.D.
Dictionary of the English Language, by Smart.
Dictionary of the English Language, by Nuttall.
Dictionary of Military Science, by Lieutenant E. S. W. Campbell.
Dictionary, Philosophical, by Hutton.
Elementary Lectures on Military Law, by Captain Tulloch.
Encyclopædia Britannica (1875).
Field Exercise and Evolutions of the Army.
Field Fortification, by Macaulay.
Field Fortification, a Manual of Military Sketching and Reconnaissance. Published by authority.
Fortification, by Arnetti.
Fortification and other Military Subjects as carried on at the Royal Military Academy, Woolwich.
Gunnery, by Hyde.
Gunpowder, by Majors Badeley, Anderson, Goodenough, and Captains Smith and Morgan.
Holtzapffel's Turning and Mechanical Manipulation.
Handbook for Field Service, by General Lefroy, R.A.
Handbook of the Mechanical Arts, by R. Scott Burns.
Handbook for Military Artificers, 1875, by Sergeant-Major T. Armstrong, R.A.
Handbook of Natural Philosophy, by Lardner.
Heather on Mathematical Instruments.
History of the Dress of the British Soldier, by Lieutenant-Colonel J. Luard.
How we are to govern Ourselves, by Alban de Fonblanque.
Indian and Burman Timbers, by Conductor Skinner.
Instructions in the Duties of Cavalry reconnoitring an Enemy, for the use of Auxiliary Cavalry.
Instructions in Military Engineering. Published by authority.
Journals of the Royal United Service Institution.
Manual of Artillery Exercises, 1875.
Manual of Instructions for Testing the Defective Vision of Soldiers, by Surgeon-General J. Longmore, C.B.
Manual of Military Law, by Colonel Pipon and J. Collier, Esq.
Manuel complet à l'Usage des Candidats au Grade d'Officier d'Infanterie, par A. Turlin.
Maunder's Treasury of Knowledge.
Mayhew on the Horse.
Mechanic's Magazine.
Military Carriages, Treatise on, by Captain Kemmis, R.A.
Military Law, by Clode.
Mutiny Act and Articles of War.
Motion of Projectiles, by Lieutenant-Colonel Owen, R.A.
Operations of War, by Colonel Hamley, 2nd and 3rd editions.
Queen's Regulations, 1873.
Regulations and Instructions for Encampments for 1875.
Revue Militaire de l'Étranger (Paris).
Revue d'Artillerie.
Rifle Exercises and Musketry Instructions.
Royal Artillery, History of, by Captain Duncan, R.A.
Sandhurst Papers.
Science, La, des Personnes de Cour, d'Épée et de Robe.
Short Notes on Field Batteries, by Captain Orde Browne, R.A.

Simmons on Courts-martial.
Small's Veterinary Tablet.
Soldier's Pocket-book, by Major-General Sir G. Wolseley, K.C.B.
Spectateur Militaire (Paris).
Steam Engine, by Robert S. Burns.
Tactics and Strategy, by General Twemlow, R.A.
Text-book of the Construction and Manufacture of the Rifled Ordnance in the British Service, by Captain Stoney and Captain C. Jones, R.A.
Text-book for School of Musketry at Hythe.
Theory of War, by Colonel (now General) Macdougall.
Tomlinson's Cyclopædia of the Useful Arts and Manufactures.
Weale's Series.
English and foreign newspapers.

# ABBREVIATIONS.

| | |
|---|---|
| B.L. | Breech-loading. |
| B.L.R. | Breech-loading rifled. |
| C.B. | Companion of the Bath. |
| C.O. | Commanding officer. |
| D.A.Q.M.G. | Deputy assistant quartermaster-general. |
| F.G. | Fine grain.<br>Field gun. |
| F.S. | Field service. |
| G.C. | Good conduct. |
| G.C.B. | Grand Cross of the Bath. |
| G.S. | General service. |
| G.S.W. | General service wagon. |
| K.C.B. | Knight Commander of the Bath. |
| L.G. | Large grain. |
| L.L.R. | Line of least resistance. |
| L.S. | Land service. |
| M.L. | Muzzle-loading. |
| M.L.R. | Muzzle-loading rifled. |
| M.T. | Mountain train. |
| N.C. | Non-commissioned. |
| N.C.O. | Non-commisioned officer. |
| N.P. | New pattern. |
| N.W. | North-west. |
| O.P. | Old pattern. |
| P. | Pebble. |
| R.A. | Royal artillery. |
| R.C.D. | Royal carriage department. |
| R.E. | Royal engineers. |
| R.F.G. | Rifle fine grain. |
| R.G.F. | Royal gun factory. |
| R.L. | Royal laboratory. |
| R.L.G. | Rifle large grain. |
| R.M.A. | Royal Military Academy. |
| S.A. | Small-arms. |

| | |
|---|---|
| S.A.A. | Small-arm ammunition. |
| S.B. | Smooth-bore. |
| S.C. | Scrap carriage. |
| S.O. | Staff officer. |
| S.S. | Sea service. |
| V.C. | Victoria Cross. |

° over a figure denotes *degrees.*
′ „ „ *minutes.*

## CORRIGENDA.

Page 51, line 18 from top of right column, *for* "5" *read* "6."
„ 59, „ 3 „ left „ *for* "former" *read* "latter."
„ 59, „ 5 „ „ „ *for* "latter" *read* "former."
„ 77, lines 3 & 4 „ right „ *for* "Non-commissioned officers of artillery wear," &c., *read* "All other non-commissioned officers wear," &c.
„ 186, line 1 from bottom of right column, *for* "7" *read* "4." (*Vide* Addenda, Heavy Cavalry.)
„ 305, „ 4 „ „ „ *for* "traversely" *read* "transversely."
„ 351, „ 22 from top of left column, *for* "1-prs. and ½-prs." *read* "1 lb. and ½ lb."
„ 415, „ 12 „ right „ *for* "or" *read* "and."
„ 425, „ 7 „ left „ *for* "of war" *read* "in warfare."
„ 434, „ 16 „ right „ *erase* "and the Whitehead (fish)."

NOTE.—Any changes that have taken place in the book while it has been passing through the press, in the matter of the pay of the soldier, &c., will be found corrected either in the Addenda or Appendix.

Where the word "reconnaissance" has been spelt "reconnoissance," the reader is requested to make the alteration.

# MILITARY DICTIONARY.

## A.

**Abandon, To**—In a military sense to retire suddenly from a place, fortified or otherwise, thus leaving it and the inhabitants to the mercy of the enemy. Hence the saying, "to abandon a fortress, siege," &c.

**Abatis** (French *abattre*, to fell)—An abatis is one of the "obstacles" used in the defence of field works. It is formed of trees, or the limbs of trees, of a considerable size, 12 or 15 feet long, laid close together. The stems are firmly secured to the ground by being buried in the earth and fastened down by pickets, or by logs of wood laid across them. To be efficient, the larger branches must be pointed and spread towards the enemy, the smaller being cut away. Abatis should be so placed as not to be exposed to the fire of artillery. In intrenchments, they are usually placed in an upright position against the counterscarp, or at the foot of the glacis, the plane of which is broken so as to permit of their being laid out of sight of the enemy, and at the same time not to interfere with the musketry fire from the parapet in their rear. An excellent mode of blocking up a road is to place an abatis across it, and when the branches are well and properly placed, and interwoven one within the other, the disentangling of them is extremely difficult. An abatis should not be planted out of musketry range; for this, and all other obstacles, are intended to break up the order of the enemy's advance; to impede, and to keep him under musketry fire.

**Academy**—Takes its name from a villa situated about a mile from the city of Athens, where Plato and his followers assembled for conversing on philosophical subjects; and hence they acquired the name of *Academics*. The term *academy* is commonly applied to any class of school which professes to communicate more than the mere elements of instruction, and is frequently used now for a regular society or company of learned men, associated together for the cultivation and improvement of the arts and sciences. In England and on the continent there are several institutions termed academies for the promotion of scientific subjects and literature, which are doubtless well known to most people. The Military Academy at Woolwich, for the instruction of the artillery and engineers of the army, was instituted by George II. in 1741, that is to say, the warrant founding the Academy was issued in that year, but the Cadet Company was not formed until four years later. For an interesting account of the early formation of the Academy, *vide* Captain Duncan's 'History of the Royal Artillery.'

The regulations for the admission of candidates to the Academy will be found in the Appendix A.

**Accelerated Motion** — When a body continually increases its motion over successive portions of space, in equal times, it is called *accelerated motion*. And when the spaces described continually decrease, it is called *retarded motion*.

**Accelerating Force**—Force considered only with reference to velocity generated, and not with reference to the mass, moved. Accelerating force, if uniform, is measured by the velocity generated in a unit of time; if variable, by the velocity which would be generated in a unit of time if the force were continued constant during that unit. The best example of such uniform motion is that of a falling body.

**Accessible**—A position, fortified or otherwise, and capable of being approached by land or water—i.e. it may be entered on those sides.

**Accountant-General of the Army**—An officer who has the control of military finance. He includes in his office that of chief auditor, an amalgamation with that of accountant-general, which took place by order of the Secretary of State for War in 1870.

**Accounts, Public**—Form the systematic record of State Expenditure. The accounts should exhibit, methodically, under proper heads, all receipts and disbursements of public money, stores, &c. To secure efficiency in these matters, accounts should be promptly rendered in the simplest and most correct manner.

The War Office "forms" show the method of keeping the accounts of all establishments under its orders.

**Accoutrements**—The belts, which support the arms, pouch, or pouches, of a soldier. The belts in use in the British army are made, for the most part, of "buff" leather. Articles of regimental accoutrements and appointments are directed to be marked with the number of the regiment to which they belong. The marks are to be carefully and legibly placed on the inside of the belts, pouches, slings, &c.

**Acid, Nitric** ($NO_5$)—Found in combination with potassa, soda, lime and magnesia; also in the pools and springs in the neighbourhood of populous towns; and in rain water after thunder storms; but it has never been found in a separate state. Nitric acid is commonly prepared from sulphuric acid (oil of vitriol) and nitre, by distillation. There are also other processes pursued in preparing nitric acid. The impure nitric acid of commerce is known by the name of "aqua fortis."

Nitric acid is one of the ingredients used in browning arms, and also in the preparation of fulminate of mercury. It is also used, in combination with sulphuric acid, in the preparation of gun-cotton, and in solution, as a bath for galvanic batteries. It is a powerful oxidiser, and acts strongly on metals. A few drops poured into the vent of a spiked gun will facilitate the operation of extracting the spike.

The common mode of testing nitric acid is to dilute half an ounce of it in a quarter of an ounce of distilled water, then to pour in, say, six or seven drops of nitrate of barytes; should it retain its colour, it indicates that it is free from muriatic acid. As nitric acid may also contain sulphuric acid, it will be necessary, in order to detect it, to pour in a few drops of nitrate of silver, when, should it remain colourless, it proves that it is free from the above-mentioned acid.

**Acid, Sulphuric** ($SO_3$)—One of the most important acids known. Dr. O'Shaughnessy, in his 'Manual of Chemistry,' thus describes its value:—"It would be impossible to exaggerate the importance of this acid, whether we consider it with reference to abstract science, to the condition of our manufactures, or the purposes of medicine. By the assistance of this acid we prepare almost all the others; for instance, the nitric, muriatic, tartaric, citric, &c. We owe to it the cheapest mode of obtaining artificial soda, chlorine, and its bleaching components. It is essential to the processes of the dyer. In fact, from the time that sulphuric acid was first prepared at a cheap price in Europe, may be dated the commencement of her greatness in all chemical manufactures." In Southern India it has been prepared for many centuries. The process pursued in the preparation of sulphuric acid will be found in all chemical works.

Sulphuric acid, in a diluted state, is made use of in percussion cap factories for the purpose of cleansing the sheets of copper of all oxide of copper which may collect on them. It is also used in the preparation of gun-cotton (sp. gr. 1·845).

**Acids**—Form a very numerous and important class of bodies in chemistry. The common idea of an acid is a soluble substance possessing the property of sourness. The chemist, however, disregards this property, and considers all those substances to be acids which impart a red colour to blue litmus paper, and form stable, neutral, and crystallisable compounds with bases, such as alkalies and earths, or metals or their oxides.

**Acquittance Roll**—A document in which is shown the monthly settlement of the accounts of a troop, battery, or company, and to which the signature of the soldier is attached, countersigned by the captain or officer in charge.

**Action**—An engagement or battle between opposing forces; or some memorable act done by an officer, soldier, or detachment. The term is commonly used in artillery exercise when guns are brought into or change position, with the view of attacking an opposing object.

**Acts of Hostility**—Proceedings of a diplomatic, commercial, or military character, involving a state of war between two or more nations. This was exemplified in 1870 in the altercation between Count Benedetti, the French ambassador, at the Court of Berlin, and the King of Prussia at the Kursaal of Ems. This is an instance of the first-named act of hostility. The second is shown in the case of the embargo laid on British shipping by the first Napoleon after the peace of Amiens in 1803. The third consists in the invasion of a friendly territory or firing on armed vessels of a friendly nation. A further act of hostility of a civil character is the forcible detention of the subjects of a friendly nation, which was exemplified in the seizing of non-belligerent British subjects residing in France in 1803.

**Adapter**—A gun-metal bush, used when shells, having the obsolete Moorsom gauge fuze-hole, are fired with fuzes which are not adapted to this fuze-hole. The pattern adapter now in use is known as the "G.S. adapter," which screws into the Moorsom fuze-hole. There are two distinct adapters, one for spherical shell, the other for rifled shell. Up to the year 1867 all shells for the larger rifled ordnance down to the 40-pr. L.S. and the 20-pr. S.S. common shell were made with the Moorsom or naval fuze-hole. Since then all new shells have been tapped with what is termed the G S. gauge fuze-hole, and shells already in the service which have not this sized hole receive the G.S. adapter. The shape of the inside of the adapter is conical, the outside cylindrical.

**Adjutant** (Latin *adjuvare*, to help)—An officer appointed to each regiment, to assist the commanding officer in the execution of all details of duty and discipline. An adjutant should be an officer of active habits, keen sight, a good rider, and, above all, a good "drill." Much of his time should be spent on the parade ground in the drilling of recruits and all duties tending to the discipline and setting up of his regiment. He inspects all escorts and guards, issues and receives orders from the commanding officer for the information of officers commanding companies, and he promulgates to the regiment, in general, all orders he may receive. He is accountable to the commanding officer for the correctness of the regimental books, and is bound to bring to his notice all infraction of rules or orders. From the foregoing it will be seen that the duties of an adjutant are unremitting. Agreeably to the Queen's Regulations, no officer is eligible for the appointment of adjutant who has not obtained a first-class certificate at the School of Musketry, unless the regiment is on service abroad, and even then under certain restrictions.

An adjutant, generally holding the rank of captain, is appointed to each brigade of artillery, to divisions of artillery of two or more batteries detached from their head-quarters, and as his duties are somewhat different to those of a line or cavalry regiment, it may not be out of place to detail them.

The duties, then, of an artillery brigade adjutant are, to a great extent, confined to his office, as the several batteries composing his brigade are often stationed far from their head-quarters. In his office are kept the books and records of the brigade; from it he circulates to detached batteries all orders received from the commanding officer and higher authority. He prepares correspondence on questions relating to the claims, services, enlistments, discharges, &c., of the men of his brigade; and when acting as the staff officer of the R.A. in the division, he has to prepare all local returns which are submitted to the general officer commanding. He has, besides, to attend to the usual duties of the guards, prisoners, courts-martial, &c. As regards drill, commanding officers of batteries carry out or work their own drills independently, and recruits are trained at Woolwich, or at the centres of sub-divisions of districts. The adjutant is responsible to the commanding officer for the state of exactness with which the regimental books are kept, and for the correctness of the duty rosters. He is to give his attention to everything appertaining to the discipline of his brigade, bringing to the notice of the commanding officer any irregularity or deviation from the established rules and regulations. In fact, nothing should escape his attention and observation.

**Adjutant-General**—One of the chief staff officers of the army, through whom all orders are promulgated, and to whom all reports are sent for the information of the commander-in-chief. The duties of the adjutant-general relate to the discipline, military training, and general efficiency of the army. In peace time, all correspondence regarding leave of absence, discharges, recruiting, and a variety of other subjects (*vide* the 'Soldier's Pocket Book') passes through his office. On a campaign, in subordination to the chief of the staff (should there be such an officer with the force), he regulates the daily duties of the force, and during a siege details the working parties on the requisition of the commanding engineer. He keeps an exact state of each division and brigade, with a roll of the general and field officers; he distributes the orders of the day to the several assistant adjutants-general of divisions, and informs them of every detail which may concern the general of the division and those under his command. Communications are made to him on the field by officers sent with or for orders in the absence of a chief of the staff.

To his department at the Horse Guards are attached a deputy, assistant, and deputy assistant adjutant-general, to assist him in carrying out the duties of his office. The two first-named officers must be field officers. This rule in India, however, is sometimes departed from in the rank of the officers appointed to some of the grades of the department. The Queen's Regulations lay down that the deputy assistant adjutant-general should not be under the rank of captain in the army without he is specially recommended.

**Assistant Adjutant-General**—A field officer and a subordinate member of the adjutant-general's department. An officer of this rank is attached to each division of the army. His duties include the submission of reports on discipline, military duties, training, and efficiency, to the general officer commanding the division. Through his department the bulk of the correspondence on arms, accoutrements, ammunition, &c., passes before being sent on to the control department.

Special reports on articles issued experimentally, suggestions or complaints as to regulation articles, and any differences which may arise between commanding officers and the control, all go through his office.

In time of war the assistant adjutant-general of each division carries out, under instructions from the general of his division, the orders issued by the chief of the staff.

**Assistant Adjutant-General, Deputy**—A subordinate officer of the adjutant-general's department who performs similar duties to those of an assistant adjutant-general. In the field, a deputy assistant adjutant-general is attached to each division.

**Administration, Military**—Relates to the system observed in all governments for the guidance of military affairs in each country. The Secretary of War directs the whole of the military administration, and has under him certain important officials who are charged with superintending the discipline of the army and the national reserves, supplies, payment of the forces, the military manufactures and armament of the country. In his office (War Office) there is a section representing each civil department serving with the army, and charged with the duty of directing and supplying those departments with all things required to maintain their efficiency.

**Advanced Guard**—A detachment or specially organised body of troops composed of the three arms, which always precedes the march of the main body of an army for the purpose of facilitating the march and guarding against surprise. Another object of an advanced guard is to procure information when an army is marching upon an enemy. This latter circumstance is remarked on in the Royal Institution prize essay of 1874, by Lieutenant S. C. Pratt, R.A., in the following terms: "An advanced guard has two opposite functions to perform—one, to be the eyes and feelers of an army; the other, to arrest and contain the enemy. In order to perform the first, the troops should be of the lightest description, and chiefly cavalry. To attain the second, the main constituent should be a powerful infantry and artillery. The endeavour to reconcile these conflicting functions is, without doubt, the reason of the great differences in the constitution of advanced guards as laid down by authorities on tactics.

"The present tendency is to restrict them, more or less, to the latter duty; fulfilling the former by the employment of independent bodies of cavalry, one or more days' march ahead of the army."

The former mode was the custom of the first Napoleon, and the custom of the Prussians in the Franco-Prussian war of 1870, and this is undoubtedly the proper method of "feeling one's way" in a hostile country.

The duty of the advanced guard should be, while not allowing itself to be entangled with a superior force, it must not, as Colonel Hamley shows in his 'Operations of War,' "allow the march to be delayed by demonstrations made by insignificant bodies. The commander, therefore, has need of prudence and resolution; he must, according to circumstances, dispute the ground, fall back towards the army, or promptly attack."

The strength of the advanced guard, or the proportion to the main body, is laid down by some of the chief continental powers to be from $\frac{1}{4}$ to $\frac{1}{6}$ of the main body. Sir G. Wolseley, the author of the 'Soldier's Pocket Book,' approves of from $\frac{1}{3}$ to $\frac{1}{10}$ of the whole force. It may therefore be assumed, as stated by Lieutenant Pratt, that $\frac{1}{6}$ will be the proportion.

The order of march of an advanced guard Colonel Hamley explains as follows:—"A small party of horse precedes the main body of the advanced guard to obtain and bring the earliest intelligence. Of the main body, a portion of the infantry march first; for neither artillery nor cavalry should enter any defile which has not been first explored, and its flanks secured by infantry.

"The artillery may, in general, properly be placed next the leading battalion, or part of a battalion, of the advanced guard."

The cavalry would cover the flanks of the column.

The maximum distance of an advanced guard from the main column of a large army should not exceed five miles, without some overpowering advantage is to be gained, such as seizing on some point or position, the possession of which would be worth the risk. In the 'Soldier's Pocket Book,' it is laid down as a rule "that the ordinary distance of an advanced guard from the head of the main body should be about equal to the depth of the column."

**Advanced Posts**—Positions taken up by a force in advance of the main body of an army, and in such a situation that they shall be within easy communication of it, and of one another; but the distance depends greatly on the nature of the country. The object of advanced posts is to prevent a sudden rush of the enemy upon the main body, and to give it time to turn out: this being afforded, the advanced posts fall back on their supports, and join the main body. The term advanced posts is also applied to picquets and such fortified posts or villages in advance of the main line of battle.

**Advanced Works**—In fortification, are those constructed beyond the glacis, but within musketry fire of the main works.

**Advancement**—In a military sense, signifies honour, promotion from a lower to a higher grade, or preferment, in an army, regiment, or company.

**Adze, Indian,** or **Bassoolah**—A small adze, which, in place of being circular like the European adze, is formed at a direct angle of about 45 or 50 degrees; its handle is very short, and it is used with great precision by the nearly exclusive motion of the elbow-joint.

**Aeen**—(*Terminalia glabra*)—A tree which grows in the Madras Presidency at Coimbatore. It is very hard, heavy, and durable under water. It is said to be found in all the teak forests of India and Burmah. A cubic foot of unseasoned wood weighs from seventy to seventy-three pounds. It is used in the Bombay Gun-carriage Agency for shafts, handspikes, and yokes.

**Affair**—In a military sense, means any minor action or engagement. Major Knollys, in his 'Handy Dictionary of Military Terms,' describes an "affair" as "more important than a skirmish, and less so than a battle."

**Affidavit**—In military law, implies an oath in writing, sworn before a person duly authorised to administer it.

**Affirmation**—A solemn declaration made before a court of justice or court-martial by those who, from different views of religion, are considered incompetent, or are unwilling, to give evidence on oath, as ruled in our several courts. Formerly, no evidence could be given except upon oath; but the privilege of making a solemn affirmation, instead of swearing on the Bible, has been extended to Quakers, Moravians, and Separatists in all cases; and to persons alleging conscientious motives in civil proceedings.

Before native courts-martial in India, evidence is given on solemn affirmation.

**Agent**—A person employed to transact business for another, and in whose place he acts. The decision of the agent, on matters appertaining to the business he is entrusted with, is looked on as binding. In India the name "agent" is given to certain high officers of the state, to whom are committed by the Viceroy political powers in dealing with native states.

**Agent, Army**—A kind of military banker, authorized by the government to manage the monetary affairs of a regiment. When purchase was the system in the army, the sale and purchase of officers' commissions were transacted by them. It is ordered in the Queen's Regulations that officers on leave should furnish their address to the regimental agent, in order that they may be readily communicated with.

**Aide-de-camp**—An officer attached to the personal staff of a general officer in the field, or in garrison. He receives and carries all orders given to him by the general on the field of battle. He must be particular in delivering them in the most distinct manner, so that there should be no miscarriage in the instructions entrusted to him. This is a post of great importance during a campaign, and only officers of intelligence and smartness should be appointed. It is stated by Marshal de Puysegur that the loss of a battle was occasioned by the incapacity of an aide-de-camp. During the Crimean War, by the misconception of a message sent by Lord Raglan to Lord Lucan, the Earl of Cardigan had to carry out a military movement which resulted in a very severe loss of cavalry.

In quarters an aide-de-camp assists the general in official correspondence, in introducing military officers, and in dispensing the courtesies of the general's house. Before an officer can be appointed an aide-de-camp he must have served two years with his regiment, and have passed the prescribed examination as laid down in the Queen's Regulations. If in India, he must have passed the examination directed in the army regulations of that country, which necessitates passing in certain native languages.

The number of aides-de-camp allotted to general officers in the field is as follows:—

Four, to the officer commanding-in-chief;
Two, to divisional generals;
One, to brigadier.

Extra aides receive forage, but no pay.

Aides-de-camp are attached to the sovereign, and to governors of provinces; in the former case, the appointment carries with it the rank of colonel in the army. The position of Queen's aide-de-camp, besides conferring rank, carries pay with it to a limited number.

**Aiguillette** (French *aiguille*, a needle)—An ornament of gold or silver cord worn formerly on the right shoulder by general officers; it is now chiefly confined to the dress of officers of the Life Guards and Horse Guards.

Aiguillettes appear to have been introduced in the early part of the sixteenth century, and were generally worn by the troopers, as well as the officers, at that time. They were subsequently superseded towards the end of that century by epaulettes, though worn up to a much later date by general officers.

**Aim, To**—In drill or action, to bring the musket or piece of ordnance to the proper line of direction with the object intended to be struck. To enable the proper elevation to be given, *sights* are attached to all small-arms and ordnance.

**Air Gun**—A pneumatic machine for propelling bullets, which, by its peculiar formation, admits of the air being compressed or condensed within it, in a strong metal ball, furnished with a small hole and a valve opening inwards. This ball is screwed to a barrel containing a bullet; upon turning a cock and opening a communication between the condensed air and the bullet, the latter will be projected forward with a greater or less velocity, according to the state of the condensation and the weight of the bullet.

**Air Pump**—A machine constructed for exhausting the air from a closed vessel, which is called a *receiver*. It consists of a glass-receiver, and a pipe connecting it with two barrels by means of two valves, which open upwards. In these barrels are two air-tight pistons, also furnished with valves opening upwards, which are worked up and down by means of a rack and wheel. The principle of the air pump is as follows:—The pistons work up and down alternately, one ascending as the other descends. The piston rising from the bottom of the cylinder causes a partial vacuum, and the elastic force of the air in the receiver pressing on the valve, opens it and fills the cylinder. On the descent of the piston, the valve in the pipe leading to the receiver closes by the pressure of air on it, and the valve in the piston opens from the same cause, until all the air in the cylinder is expelled. A succession of strokes in this way rarifies the air in the receiver, until the elastic force of all that remains is insufficient to open the valves, when the action of the pump ceases.

**Air, Resistance of**—More especially with reference to projectiles, is of the highest importance in the science of Ballistics. The resistance increases in a high ratio with the velocity. Without this resistance a musket ball would, at an angle of 25°, be thrown seventeen times further than with it. Hutton's experiments led him to believe that the resistance of the air increased a little more rapidly than the square of the velocity. The French experiments have led to an expression involving the square and the cube of the velocity. It is of the following form for spherical projectiles:

$$\rho = 0{\cdot}0005213\ \pi R v^2 \left(1 + \frac{v}{1426{\cdot}4}\right)\frac{\delta}{534{\cdot}3}$$

in which $\rho$ represents the resistance of the air in pounds weight; $\pi$, the ratio of the circumference to the diameter; R, the diameter of the projectiles in feet; $v$, the velocity in feet per second; and $\delta$, the density of the air at the time of observation. For ordinary purposes $\frac{\delta}{534{\cdot}5}$ may be taken as unity.

For elongated projectiles, the co-efficient 0·0005213 = A is replaced by 0·0003475; but in some instances the former co-efficient has been found to be the most correct even for elongated projectiles.

The resistance of the air gives rise to a ballistic co-efficient C, peculiar to each projectile.

This is calculated from the formulæ:

$$C = \frac{1}{2g}\frac{P}{A\pi R^2} = \frac{2}{3}\frac{RD}{gA}$$

in which $g$, A, $\pi$, R, are the same as before; P, weight of projectile in pounds; D, the density of the projectile, and A, its appropriate value, according as the projectile is spherical or elongated. The co-efficient C is one of the data required in finding the multipliers B (a point), D, &c., used in the formulæ for the trajectory in the air.

Colonel Majefsky, of the Russian artillery, has proposed a formula involving the square and the fourth power of the velocity, which is said to give results even closer to practice than the French formulæ above detailed.

The following short table, calculated by the formulæ, will give an idea of the amount of the resistance of the air.

| Velocity of Projectiles. | RESISTANCE IN lbs. AVOIR. | | | |
|---|---|---|---|---|
| | 24-Pr. Shot. | 12-Pr. Shot. | Musket Bullet. | 10-Inch C. Shell. |
| 1600 feet | 479 | 302 | 7 | .. |
| 1400 „ | 343 | 216 | 5 | .. |
| 1200 „ | 234 | 147 | 3 | .. |
| 1000 „ | 150 | 95 | 2 | 462 |
| 800 „ | 88 | 56 | 1 | 271 |
| 600 „ | 45 | 28 | 0·7 | 139 |
| 400 „ | 18 | 11 | 0·3 | 56 |

On examining the above, it appears that the resistance decreases very rapidly with the velocity.

In effect, at a velocity of 800 feet, the resistance is less than one-fifth of that corresponding to the double velocity of 1600 feet. Comparatively to the 24-pr. round shot, the resistance to the 12-pr., one-half its weight, is only about two-thirds of the former; that to the musket bullet, weighing $\frac{1}{384}$ of the same round shot, is but the 68th part. The 10-in. common shell, weighing nearly four times as much, meets with a resistance which is only three times that of the 24-pr., despite the inferiority of its density.

At a velocity of 1600 feet per second, the resistance opposed to the 24-pr. shot is 479 lbs., or twenty times its own weight; at a much smaller velocity of 600 feet per second, the resistance to projectiles is still in proportion to their weight; thus, nearly double for the 24-pr., more than double for the 12-pr., nearly ten times for the musket bullet, and nearly half as great again for the 10-in. shell.

**Aketon,** or **Hacqueton**—A quilted leathern jacket worn under the armour of knights in the thirteenth and fourteenth centuries.

**Alarm**—The following meaning of this term is given in 'Chambers's Encyclopædia':—"In military matters the word alarm has a more defined meaning than mere terror or fright. An alarm, among soldiers in an army, is not so much a danger as a warning against danger. An alarm, signified by the firing of a gun or the beating of a drum, denotes to an army or camp that the enemy is suspected of intending a sudden surprise, or that the surprise has actually been made. There is an *alarm post* in camp or garrison arrangements, to which the troops are directed to hasten on any sudden alarm being given."

**Alarm Gun**—Formerly, three guns were placed in front of a camp, 100 paces from the artillery posts, ready to be fired, as an alarm to the troops, in case of a sudden attack by the enemy.

**Alarm Post**—A place told off on the arrival of a force into a new quarter, camp, or bivouac, where the men are to repair in case of any sudden alarm by day or night. The parade is generally looked upon as the alarm post; officers and men should proceed there ready armed, on the alarm being sounded, should no other place be appointed.

When an army is in the field, there are two alarm signals:

1. For general concentration, on which everybody acts according to instructions.
2. Partial, when regiments re-assemble at their own rendezvous.

The second alarm signal should be frequently practised, for it is very important to know how long it takes to get the men together at any hour.

It is ordered in the Queen's Regulations that although a regiment or a division may remain for only a single night in a quarter, yet an alarm post, or place of assembly, is invariably to be established in each regiment, and the troops are to be made acquainted with its position, and officers commanding regiments, with that of the brigade to which they belong.

**Alarms, False**—Stratagems of war frequently made use of to harass an enemy by keeping him perpetually under arms. A vigilant officer will occasionally make a false alarm to try if his guard is on the alert. A fearful or negligent sentinel will create alarm by false reports.

**Alcohol**—A term of Arabic origin, implying the pure spirit obtained by distillation from all liquids which have suffered the vinous fermentation. Alcohol is transparent, colourless, and inflammable. It unites easily with resins, camphor, antimony, and volatile oils. It is known as "spirits of wine." Its specific gravity on becoming absolute alcohol is from ·796 to ·800, and it boils at 176°. It is used in the preparation of laboratory stores, such as fulminate of mercury, quick-match, shell-lac to form varnish for percussion caps, &c.

**Alder** (*Rhamnus Frangula*)—A tree, the charcoal of which is made use of in England in the manufacture of gunpowder. The wood is of an orange yellow colour; it is not very good for fuel, but very durable under water. This tree seldom exceeds 40 feet in height.

**Aldershot Camp**—A permanent military camp, situated on the borders of Surrey, Hants, and Berks. When first established, which was in 1855, only wooden huts were erected for officers and men, but these to a great extent have been superseded by barracks which are well built, and which have much to recommend them in the convenience they afford to the occupants. The situation of the camp is conveniently placed for the quick transmission of troops to any part of the southern coast. It is also within easy reach of many of our railway stations on the South-Western and South-Eastern Railways. The camp is divided by the Basingstoke Canal, which runs across the Heath, into the North and South Camps. The country round about the camp is well suited for the assembling and manœuvring of troops, and advantage has been taken of its capabilities to render it an efficient drill ground.

**Alert**—In military phraseology an expression made use of to signify that an outpost has been threatened or attacked. Thus, "We have had an alert," is a military phrase. A bugle-sound is also so named, which is given by way of warning to put soldiers on their guard, and to keep them vigilant. This warning is also sounded by an outpost which may be attacked in the night, to give notice to the one that is destined to support it. The word, as shown by Major Knollys, is frequently used by old writers to express a sudden alarm caused by a merely harassing attack of the enemy.

**Algebra**—Literal arithmetic, or the science by which quantity and the operations of quantity are expressed by conventional symbols.

**Alien** (Latin *alienus*, belonging to another)—'Chambers's Encyclopædia' states as follows on the meaning of the word:—"The citizen of one state, when resident in another, unless naturalised, is an alien. The condition of an alien does not necessarily result from foreign birth, for the son of a natural-born or naturalised Englishman is not an alien, wherever he may be born. This privilege even extends to the second generation on the father's side; and thus a man whose paternal grandfather was an Englishman, is an Englishman himself, unless either his father or grandfather be liable to the penalties of felony, has been attainted of treason, or be serving in the army of a prince at war with England at the period of his birth. Neither is this privilege affected by the fact that the mothers of such persons were foreigners. The children of aliens born in England, except in the case of a hostile invasion, are natural-born subjects; but the children of English women by aliens are aliens, unless born within the British dominions. By 7 and 8 Vict. c. 66, s. 16, alien women married to natural-born subjects are naturalised. The allegiance due by an alien or stranger to the prince in whose dominions he resides is usually called *local* or *temporary allegiance.* It differs from natural allegiance chiefly in this, that whereas natural allegiance is perpetual and unaffected by change of residence, local allegiance ceases when the stranger transfers himself to another kingdom."

**Alignment** (French *aligner*, to place in a line)—In military exercise, is the imaginary straight line that lies between any two given points on which a line may be formed, or the pivot flanks of a column dressed.

**Alkali**—A soluble body, with a hot caustic taste, which possesses the power of destroying or neutralising acidity. The word is derived from the Arabic article *al*, and *kali*, the Arabic name of a plant, from the ashes of which one of the most important alkalies (potash) is obtained.

**Allegiance** (Latin *alligo*, to bind to, or attach)—As explained in the 'Encyclopædia Britannica,' ninth edition, is "the duty which a person possessing the privilege of a citizen owes to the state to which he belongs, and is technically applied in law to the duty which a British subject owes to the sovereign as representing the state. It has been divided by the English legal commentators into natural and local; the latter applying only to the deference which a foreigner must pay to the institutions of the country in which he happens to live; but it is in its wider sense that the word is important, as representing a condition attached to mankind of which it is very difficult in theory, and still more in practice, to adjust the true character and limits. Accordingly, as the law stood before 1870, every person born within the British dominions, though he should be removed in infancy to another country where his family resides, owes an allegiance to the British crown which he could never resign or lose except by act of parliament, or by the recognition of the independence or the cession of the portion of the British territory in which he resided. By the Naturalisation Act of 1870, it was made possible for British subjects to renounce their nationality and allegiance, and the ways in which that nationality is lost are defined. So British subjects voluntarily naturalised in a foreign state are deemed aliens from the time of such naturalisation; unless, in the case of persons naturalised before the passing of the Act, they have declared their desire to remain British subjects within two years from the passing of the Act."

**Alloy**—The combination of one metal with another, except when mercury enters into the compound, when it is known as an amalgam.

The following constitute a few of the alloys of various metals:—

Bronze gun metal—copper, 90, and tin, 10.
Bell metal—copper, 78, and tin, 22.
Brass—copper, 67 to 72; zinc, 33 to 28.
Plumber's solder—tin, 67, and lead, 33.
Pewter—tin, 92, and lead, 8.

The following alloy, which expands in coating, is useful for filling small cavities in cast iron:—

9 lead, 2 antimony, 1 bismuth.

**Alum**—A double salt of great use in the Arts, especially to dyers, as well as to chemists and artists. A solution of alum has an acid reaction, and a sweetish astringent taste. The constituents of alum are sulphuric acid, alumina, an alkali, and water. The alkali may be potash, soda, or ammonia. Hence there are three distinct kinds of alum, depending on the alkali employed. Potash alum is the kind most in use.

**Ambulance** (Latin *ambulare*, to move from place to place)—In the present acceptation of the word, is essentially a medical equipment which accompanies every army in the field. It comprises more than the actual transport of the sick and wounded; it includes the medical administration of all duties relating to the wounded. On an army taking the field, the first care should be the administering to the comfort of those who are liable from wounds to be prostrated and put *hors de combat*, and with this view it is necessary to organise an ambulance establishment so that, either on the field or away from it, the wounded may be properly attended to.

In the continental armies the ambulance equipment is organised with unremitting care and attention, so that there shall be no failure in the day of need in this department of the army. In the British service the ambulance department has not received that organisation and care which could be desired, but it is under consideration, and doubtless will be a model of all that could be wished for.

To express the equipment of the ambulance department of an army, it is necessary to bear in mind that it is guided by the circumstances which require its aid. A large army requires a vast ambulance organisation to meet the necessities of the numbers who may be expected to be wounded. It is usual under the circumstances so to arrange the ambulance department that, under the head of stations, there shall be four positions in which the wounded can be attended to. 1. On the actual field of battle, where the most prominent cases can be temporarily attended to. 2. When removed, to some extent, from under fire, they can be, with less haste, administered to; and this includes those not so severely wounded. 3. Where more thorough attention can be given, and where the wounded can be fed and sent away. 4. The field hospital station, where definitive treatment will be adopted. The distance from the battle-field of the several sections alluded to is fixed by those in authority, and circumstances guide their position.

The term ambulance includes also all carts, carriages, stretchers, and cacolets used for the transport of the sick and wounded. The *personnel* of an ambulance means the medical and surgical officers of an army with their appliances, including what is now known in the British army as the Army Hospital Corps.

Baron Larrey, the chief surgeon of the armies of the first Napoleon, was the originator of *ambulances volantes*, or flying field hospitals. By the International Convention of Geneva, ambulances and their officers are declared to be neutral. (*Vide* Geneva Convention.)

Ambulances are of two kinds, military and international. The former are officered by military doctors; the latter by medical men, who volunteer their services during time of war, and who are aided by a devoted band of assistants from other nations anxious to alleviate the sufferings of the sick and wounded.

**Ambulance Corps**—A body of men unknown in the English army in peace time, but formed on the outbreak of war to attend upon the sick and wounded. The *personnel* of such a body would be taken from the Army Hospital Corps; and the ambulance carriages attached to the Transport would form the *matériel.*

**Ambulance Wagon**—A wheeled carriage on springs for the reception of wounded or sick men, some of whom can only lie down, while others are able to sit up. Ambulances are fitted up with all medical appliances as a hospital wagon. A certain number are attached to regiments, and placed at a sufficient distance in rear of the army to be out of danger, the wounded being brought on stretchers from the battle-field and transferred to the ambulance wagon. By most nations the movable field hospital is called the ambulance.

The latest pattern ambulance wagon in the British army is constructed to carry seven sick or wounded men—viz., two inside on stretchers, two seated beside the driver, and three seated in rear. One ambulance is allowed to each regiment, and fifteen to each division.

**Ambuscade** (French *embuscade*)—A snare set for the enemy, either to surprise him when marching without precaution, or by posting yourself advantageously and drawing him on by different stratagems, to attack him with superior force.

**Ambush**—Another name for ambuscade. A detachment of troops placed in concealment for the purpose of surprising and attacking an enemy.

**Ammunition**—This term is applied not only to the charges of powder for ordnance and small arms, but it also includes all kinds of projectiles used in the service, and the various appliances for igniting the charges, &c. The Woolwich Laboratory is the great military establishment for the manufacture of gun and small-arm ammunition. Other *matériel* of war may be made elsewhere, but the ammunition above alluded to is made at Woolwich. In India, ammunition of all natures, except small-arm ammunition, is made up in the arsenals of the different presidencies. (Appendix B.)

During a campaign the regimental reserve of small-arm ammunition for a battalion is carried in three carts, each containing 9600 rounds, under the charge of the officer commanding the battalion. Other reserves of ammunition, gun and small-arm, are with the artillery.

**Amnesty**—An act of oblivion, or forgiveness of past offences committed against the State. The effect of the act is, that crimes so obliterated cannot again be brought up against the guilty parties. Usually an act of amnesty is meant to comprehend a number of individuals guilty of offences of a political nature, as rebellion, &c.

**Amplitude**—In gunnery, the range of the shot, or the horizontal right line which measures the distance it has passed.

**Analysis**—In chemistry, implies the resolution of compound bodies into their components, and is distinguished as proximate or ultimate analysis, according as the substance under examination is resolved into its proximate constituents, or into its elements. In mathematics, analysis, or the analytic method, assumes the truth of the proposition to be proved, and then reasons backward until it arrives at some known truth. Analysis is the reverse of synthesis; and, therefore, when any truth has been investigated by the analytic method, the proposition may be proved directly by inverting the process.

**Anchor**—An iron instrument composed of a long shank, having a ring at one end to which the cable is fastened, and at the other branching out into two arms or flukes tending upwards with hooks or edges on each side; its use in an army equipment is to moor transports, boats, pontoons, and rafts. It is also a good hold for a capstan. The weights of anchors vary according to the particular use they are put to.

**Anemometer**—An instrument for measuring the force or velocity of the wind. The most common form of anemometer is that by Dr. Whewell and N. S. Osler.

**Aneroid**—A form of barometer invented by M. Visti, of Paris. Its action depends on the effect produced by the pressure of the atmosphere on a metallic box, which has been exhausted of air, and then hermetically sealed. An index, traversing on a dial, records the changes in the weight or pressure of the air on a given surface.

**Angle, Acute**—That which is less than a right angle.

**Angle of Clearance**—In gunnery, is the angle of elevation obtained when the top of the tangent scale and dispart sight, and the notch on the muzzle, are in line.

**Angle, Dead**—In fortification, any angle of a work the ground before which is undefended by a flank fire.

**Angle of Defence**—In fortification, is that formed by a line of defence and a flank. The angles of defence should never be less than 90° and never more than 120°.

**Angle of Departure**—In gunnery, the actual angle which the shot's path on leaving the muzzle of a gun makes with the true horizon. This, when there is windage, may differ sensibly from the *angle of inclination*, and appears also to do so in the lighter rifled guns, where the shots are observed to rise, from the muzzle being slightly thrown up. This rise is caused from the "jump" of the gun.

**Angle of Depression**—In gunnery, the angle given to a piece of ordnance when laid under metal, or at an angle below the horizon.

**Angle of Descent**—In gunnery, the angle which the tangent to the trajectory makes with the horizon at the height of the crest of the parapet, or other object to be cleared. It is rather less than the terminal angle.

**Angle of Elevation**—In gunnery, the angle between the axis of the gun and the visual line from the sight on the tangent scale to the object. It has no reference to the horizon or to any natural level.

**Angle, Flanked**—In fortification, the angle formed by the flank of the bastion and curtain, or, in other words, that formed by two lines of defence.

**Angle of Incidence**—In gunnery, the angle which the tangent to the trajectory makes with the actual surface struck at the point of descent.

**Angle of Inclination**—In gunnery, the angle which the axis of the gun forms with the true horizon, or the angle shown by a correct spirit-level. This is, consequently, the angle recorded when guns are laid by the quadrant.

**Angle, Obtuse**—That which is greater than a right angle.

**Angle, Right**—That which is made by one line perpendicular to another; it is always 90°, or the quadrant of a circle.

**Angle, Salient**—In fortification, the angle formed by two lines of works meeting and pointing towards the country. The salient angles of works ought to be as large as possible, and never less than 60°.

**Angle, Shoulder**—In fortification, the angle formed by the face and flank of a bastion.

**Angle, Terminal**—In gunnery, the angle which a tangent to the trajectory forms with the horizontal plane at the point of descent.

**Angle of Traction**—In draught, the angle which the plane of the traces makes with the road on which the carriage is moving. Artillery carriages, as Lieutenant-Colonel Owen observes, "having sometimes to move over the worst description of roads, the angle of traction must be slightly inclined upwards, as the vertical component of the pull will then assist the wheels to surmount obstacles; the weight being transferred to the shoulders of the horse, increasing the pressure of his feet upon the ground, thus giving him a firmer hold, and enabling him to exert with ease a stronger pull, while the resistance against which he contends is at the same time diminished."

**Angular Velocity**—The velocity of a body rotating round a fixed point, which is measured by the circular arc described by any point of the body at some unit of radial distance, usually one foot from the axis of rotation. The velocity of any particular point of a rotatory body may be found by multiplying its angular velocity by the radial distance of the point from the axis of rotation; and *vice versâ*, the angular velocity may be found by dividing the velocity of any known point by its radial distance.

**Anna**—An Indian term, expressing the sixteenth part of a rupee; generally, in India, applicable to the sixteenth part of anything.

**Annals**—A species of military history, wherein events are related in the chronological order in which they happened. They differ from a perfect history in being merely a relation of what passes every year, as a journal is of what passes every day.

**Annamally**—The name of a forest in the southern part of India, which yields good teak timber; the wood is made use of for ordnance purposes in the Madras Presidency.

**Annealing**—The process employed in softening certain malleable metals, which, under the action of the hammer or of the roller, have gradully increased in hardness, elasticity, and in density, from the close approximation of their particles. Articles of iron and steel are sometimes annealed by piling them in an open fire and raising them slowly to a red heat; they are then left to cool gradually. This method is injurious, on account of the oxide which forms on the surface, thereby depriving the steel of a portion of its carbon. Articles of iron and steel ought to be annealed in close vessels, and covered up with ashes or clean sand, and, after arriving at a red heat, should be allowed to cool without letting in the air. In annealing articles of iron or steel, they lose their brittle character, so that they can be bent without breaking. The opposite effect takes place in annealing copper, which becomes brittle and hard. Annealing has the property of imparting to axle-trees, after being much in use, renewed durability, and also of restoring iron, when crystallised, to its fibrous state.

**Anthracite Coal**—A non-bituminous coal containing from 80 to 90 per cent. of carbon. South Wales abounds in it. This coal is extensively used in smelting forges, and for steam engines, where freedom from smoke is required. In gunpowder factories, on this account, it is commonly used either alone or mixed with bituminous coal.

**Anti-Corrosion**—A paint formerly used in coating ordnance; it has been superseded by Pulford's magnetic paint.

**Antimony**—A metal of a grey or leaden colour, and very brittle. It is found in mines with *galena*, or the sulphuret of lead, from which it is easily distinguished, the antimony occurring in fine streaky fibrous crystalline masses of a radiated texture, whereas sulphuret of lead is of a smooth, shiny, laminated nature. Antimony is found in Cornwall, France, Spain, Borneo, Nepal, the Straits, and Siam, and is commonly associated with iron, zinc, quartz, silver, sulphate of baryta, and carbonate of zinc. It fuses at about 800° Fahr., and volatilises very perceptibly at a somewhat higher temperature. It is one of the ingredients used in the detonating composition of friction tubes, and stars for signal rockets. When mixed with lead, it has the property of hardening bullets. Sulphide of antimony enters into those compositions employed to give a strong light. It is particularly well suited for that purpose, for being decomposed at a comparatively low temperature, the metal is set free and disseminated through the flame in a state of incandescence, causing the intensity of the light to be considerable; moreover, the heated particles, coming in contact with the atmosphere, are thereby oxidised, forming a white smoke which is very favourable to the reflection of light.

**Anvil**—A block of iron, having a rectangular-shaped face. It is used essentially by blacksmiths, in the process of hammering malleable metals, either by hand or under the steam-hammer. Anvils are sometimes made of cast iron, but when required to be very hard or bright, they are made of wrought iron and faced with steel. The parts of an anvil are, the edge, face, pane or steel-cap, foot, and stock. Anvils have usually a conical end, which is used for turning pieces of iron into a circular form. The smith's anvil is generally placed on a loose wooden block, but the more firmly the anvil is connected with the earth, the more effective will be the blow of the hammer.

**Apex**—The top or highest point of a cone or pyramid.

**Appointments, Officer's**—Usually imply military accoutrements, such as belts, sashes, swords, &c.

**Appointments, N. C. Officer's**—In the mounted branch, consist of accoutrements, saddle, &c., making, with the N. C. officer, a total weight for the horse to carry of about 18 stone.

**Approaches**—All works are generally so called that are carried on towards a place which is besieged; such as the first, second, and third parallels, the trenches, redoubts, places of arms, saps, galleries, and lodgments. These concealed roads or trenches, by which the troops are able to approach the attacking point, have as their object the concealment of the attacking party, which would otherwise be exposed to imminent danger while hastening across the open country to enter the breach.

**Appui**—*Vide* Point d'Appui.

**Aprons, Gun**—Covers for the protection of the vent and tangent blocks of guns against rain and dirt. They are usually made of lead, canvas, or tarpaulin, according to the nature of the gun for which they are required.

**Arbalest**—The Norman name for cross-bow; it was adopted as a war weapon in England during the reign of Richard I.

**Archers**—Another name for bowmen, or men skilled in the use of the bow and arrow. In the early history of the world, down to the introduction of gunpowder, and even after that period, nations equipped their armies with the bow and arrow, as well as with other offensive weapons. Looking back to the early periods of our own country, we observe how skilled the Normans were in the use of the bow, both mounted and on foot, and what an important portion of his army the archers of the Conqueror were, and what invaluable service they did him at Hastings, making the bow for many centuries the chief strength of the English. To resist the formidable power of this weapon, and the no less destructive effect of the battle-axe, every means were taken to protect the knight or soldier in body armour. The force of the battle-axe, we are told, made "sad havoc with the various species of mail, breaking the links of chain, and picking off the scales and plates, leaving fatal openings for the passage of the sword and the lance."

A perusal of the history of the arms and dress of the men-at-arms, during the early period of the English nation, will show what constant changes were taking place in the armour of the soldier, all with the view of rendering him more impervious to the piercing of the deadly arrow, and proof against all the rapidly invented weapons for the purposes of destruction. Colonel Luard, in his 'History of the Dress of the British Army,' shows how "to the arrows of the Normans at the battle of Hastings is attributed the issue of that contest; a random shaft, it is well known, struck Harold in the eye and slew him." The dress of archers was generally a hauberk of mail.

**Arm**—Signifies any particular description or class of troops. The artillery, the cavalry, the infantry, and the engineers, are each an arm of the service. The word used figuratively denotes power.

**Armament**—A force equipped for war, naval or military. A name also given to the guns of a fortress, coast, or ship. The armament of a fortress depends upon the size and description of the works, as well as the nature of the locality on which they are situated, whether on a land or sea front. In the former case the guns are lighter, while on a sea front they are all of a heavier nature, and capable of piercing armour-clad vessels; the 7-inch, of 7 tons in weight, up to the 12- or 12½-inch, of 35 and 38 tons, are such guns.

In the work entitled 'Instruction in Fortification, &c., at the Royal Military Academy, Woolwich,' it is shown "(1) That the ordnance necessary for the immediate security of the place is calculated at 10 per bastion, and some as required for detached works. This provides for the armament of the salients and flank defences, and includes heavy mortars. (2) The ordnance requisite to sustain a siege. This must depend on the extent of the works generally, and, according to the best and latest authorities, fortresses of the—

| | |
|---|---|
| 1st class, consisting of 10 sides and upwards, will require 110 pieces | in addition to the 10 per bastion above mentioned. |
| 2nd class, consisting of 6 to 9 sides, 70 pieces | |
| 3rd class, consisting of 4 and 5 sides, 30 pieces | |

Thus, supposing the fortress to be armed has 8 fronts, the quantity of artillery required will be 8 × 10 + 70 = 150. The proportion of the several natures of ordnance is generally $\frac{5}{10}$ heavy guns, $\frac{1}{10}$ shell guns, $\frac{3}{10}$ mortars, $\frac{1}{10}$ field guns."*

**Arme Blanche** (French) — Literally, white arm. Arms used in hand-in-hand conflicts, such as swords, bayonets, foils, &c.

**Armistice**—A truce, or suspension of hostilities, between two armies or two nations by mutual agreement, a stated time being given for the cessation of it, when either an agreement between the contending parties is come to or a renewal of hostilities takes place.

**Armour, Body** — A defensive habit formerly worn for the defence or protection of the body. It succeeded chain-mail, which, soon after A.D. 1400, was in disuse, and complete armour of plate adopted. Complete armour consisted of a casque or helmet, a gorget, cuirass, gauntlets, tasses, brassets, cuisher, and covers for the legs, to which the spurs were fastened. This formed armour "*cap-à-pie*," and was used by the cavaliers and men-at-arms. The infantry had only part of it—viz., a pot or head-piece, a cuirass and tasses, but all light. Body armour at the present day is confined to a few regiments of heavy cavalry, and consists of the cuirass and helmet only. In Oriental armies, chain armour is partially retained. Before the introduction of gunpowder, personal conflicts between opposing troops were frequent, and body armour, which was also called *harness*, was especially used, and doubtless found to be a great protection. Besides the body armour alluded to, the horses on which the knights rode were clad in armour.

In looking back to Holy Writ, it is found that body armour was known in the earliest ages of the world. The coat of mail called "habergeon" was in use amongst the Jewish soldiery. The helmet also is of very early date, and was known as a head-dress 800 years, or earlier, B.C. The habergeon is even older than is stated.

In the 'Text Book for Officers at Schools of Musketry' the weight of the Saxon armour is thus remarked upon:—"Harold II., having observed that the heavy armour of the Saxons prevented them from pursuing the Welsh into their recesses, commanded them to use lighter weapons and armour made of leather only." Later on, however, after the Norman Conquest, chain-mail and steel armour were again worn.

**Armour Plating**—The system introduced into the navy for the purpose of protecting ships of war against the fire of artillery. The project of covering wooden ships with iron plates was first suggested by the late General Paixhans, in the year 1821, but it led to no attempt in France to cuirass ships of war, and the project was at that time abandoned. In 1854, however, the idea was reproduced by Napoleon III., who then proposed the construction of floating batteries, or ships protected on the exterior by thick plates of iron, which led to the building of the French frigate *La Gloire*. In England, experiments on the subject engaged the attention of the government as early as the years 1849 and 1851. Since then further experiments have been carried on, as to the proper thickness of iron to be given to ships of war, and the form of ship, with reference to the increased power of artillery. Turret-ships, such as the *Devastation* and *Thunderer*, have a coating of 14 inches of iron, with a wooden backing of 18 inches. Ships of the *Hercules* and the *Sultan* class, both broadside ironclads, have the bulk of their armament, 18-ton guns (400-prs.), carried in a central battery on the main deck. These two powerful vessels are also capable of acting as "rams."

---

* If fortresses be armed with the powerful rifled guns of the present day, a smaller proportion would suffice.

Not only has armour-plating been applied to ships, but to the construction of shields, 12 and 14 inches in thickness, for the protection of the embrasures of casemates, forts, &c. (*Vide* Shields.)

**Armourer, Sergeant**—A skilled mechanic attached to regiments of infantry and cavalry, for the purpose of repairing and keeping the arms in order.

**Armoury**—A building specially provided in arsenals for the deposit and preservation of small arms. An armoury should be very dry and well ventilated. In a damp climate, a "dry room" would be a desirable adjunct, for, with every care and attention, rust will make its appearance if the outer air is not excluded. The repair of the arms in armouries is carried out by civilian armourers.

**Arms**—Instruments of different forms and natures, for attack and defence. The manufacture of arms is of very ancient date, coeval with the world. Necessity drove men to make them, either in defence of themselves against wild animals or against their enemies. The first arms of offence appear to have been made of wood, such as clubs. Arms of stone, bone, and brass, succeeded clubs. Subsequently, a variety of arms of iron and steel was introduced which comprised the spear, the lance, the hatchet, the battle-axe, the bow, and several others; and though these arms were in many instances rude and unwieldy, the treatment of iron seems to have been well known; in the manufacture of steel great skill was shown, as the blades of Damascus testify, and which were famed throughout the world. In India, the tempering of steel was well known from a very early date.

The arms of the present day in the British service vary according to the branch of the army in which they are used. In the infantry, the converted Enfield (Snider) rifle was for some time the general arm of the service, but has been superseded by the Martini-Henry rifle. In the cavalry, the sword, lance, carbine, and pistol form the arms of that branch, the dragoon guards, dragoons, and hussars being equipped with the carbine and sword, the lancers with the lance and pistol. In the artillery, in addition to the guns of a battery, the following arms are provided: for a battery of horse artillery, a sword to each man of all ranks, and twelve carbines for sentry duties; for a battery of field artillery, a sword to each non-commissioned officer, artificer, or trumpeter, and to all gunners a sword bayonet, with the addition of twelve carbines for sentry duties. Heavy field batteries are similarly equipped. Garrison batteries, all ranks, except trumpeters, are furnished with a complete stand of arms, the trumpeters (and artificers, if any) having a sword bayonet.

**Arms, Bells of**—Tents or masonry buildings, formerly used in India, and to some extent at the present day, for the deposit and care of the arms of each company of a native regiment. The bells of arms were generally built in front of the lines of the regiment and behind the parade ground.

**Arms, Side**—Such arms as the soldier is entitled to wear in undress according to the branch of the service he is in; which arm, be it the bayonet or sword, is worn at the side.

**Arms, Stand of**—The complete set of arms with which a single soldier is equipped, whether horse or foot.

**Armstrong Gun**—Is a breech-loading rifled gun built up of wrought-iron coils. Sir W. Armstrong is the inventor of the coil system. The gun consists of four parts—the barrel, the breech-piece, the trunnion ring, and the coils. The barrels of the early guns were made of wrought iron, but the last manufactured were made of steel. The mode resorted to in building up the gun will be seen under the heads "Coil of a Gun" and "Gun." The Armstrong gun has been superseded by a M.L.R. gun, now the pattern gun of the service, though there are still a few B.L.R. guns in use.

**Arms of Precision**—Rifled arms of all natures. These arms have a longer range and a more accurate and rapid fire than that derived from the old smooth-bore weapons. The introduction of rifled small-arms of the present form, viz. breech-loaders, only dates back as far as 1864, when in the unequal struggle between Prussia and the Danes the former first used the needle-gun. This called the attention of the European powers to the value of breech-loading rifles. The further value of such arms was again recognised in the war of 1866 between Prussia and Austria, when the latter power met the former with only muzzle-loaders; the result is well known to his-

*Effect of Artillery Fire on Lines of Troops; 9-Pr. and 16-Pr. M.L.R. Guns; line of targets 45 feet long by 9 feet high.*

| Range. | Nature of Ammunition. | Total Hits. | |
|---|---|---|---|
| | | 9-Pr. | 16-Pr. |
| 1500 yards .. | Common shell .. .. | 46 | 36 |
| | Shrapnel „ .. .. | 92 | 345 |
| 2000 „ .. | Common „ .. .. | 26 | 30 |
| | Shrapnel „ .. .. | 75 | 276 |
| 2500 „ .. | Common „ .. .. | 24 | 36 |
| | Shrapnel „ .. .. | 106 | 131 |
| 3000 „ .. | Common „ .. .. | 13 | 32 |
| | Shrapnel „ .. .. | 66 | 105 |

Front of a company of 50 files, 34 yards long by 5 feet 6 inches high.
Front of a double company of 1 file, 68 yards long, by 5 feet 6 inches high.

*Effect of Infantry Fire, with the Snider Rifle, at the Regulation Targets, and the Proportional Effect on Bodies of Troops at different Formations at various Distances.*

| Mark aimed at. | | Ranges. | | |
|---|---|---|---|---|
| | | 200 yds. | 500 yds. | 800 yds. |
| Battalion | In line .. .. .. .. .. .. .. .. | 96· | 80·5 | 59· |
| | Quarter-column .. .. .. .. .. | 99·61 | 98·05 | 95·86 |
| | Double company quarter-column.. | 99·63 | 97·73 | 95·07 |
| ½-Battalion | Quarter-company .. .. .. .. .. | 99·41 | 97·09 | 93·85 |
| | Double company quarter-column.. | 99·23 | 96·18 | 91·86 |
| Double company | In line .. .. .. .. .. .. | 95·89 | 79·93 | 57·79 |
| | Company quarter-column .. | 98·77 | 93·99 | 87·32 |
| Company | In line .. .. .. .. .. .. .. | 95·77 | 79·36 | 56·57 |
| | Half-company column .. .. .. | 99·1 | 95·56 | 90·59 |
| | Column of sections .. .. .. .. | 98·82 | 94·17 | 87·57 |
| Regulation targets, 200 yds., 6 ft. × 4 ft.; 500 yds., 6 ft. × 6 ft.; 800 yds., 6 ft. × 8 ft. | | 90· | 61· | 28· |

C

tory—the superiority and rapidity of the Prussian fire was marked. From this period the value of breech-loaders may be said to have been recognised. France produced her Chassepot, and England the converted Enfield, known as the Snider, ultimately the Martini-Henry; and now all the continental armies are armed with breech-loaders. Colonel Hamley, in his 'Operations of War,' describes the change rifles and rifled guns have brought about in the tactics of armies. No longer is the old formation of battalion-columns resorted to —deep columns offering too good a mark for the enemy. The Prussians, therefore, during the war of 1870, finding such formations no longer safe, diminished the size of their columns in order that the fire of the enemy might prove less destructive both in front and depth, besides giving a better opportunity of taking advantage of the natural cover which average ground affords to small bodies.

The tables at page 17 show the result of practice made with rifled field guns and rifled small-arms; thus giving the reader an idea of the precision and disastrous effects of rifled arms. The table on the fire of the Snider will be interesting to all branches of the service still equipped with that arm. The practice of the Martini-Henry rifle is given under that head.

**Arms, Under**—Troops are said to be "under arms" when they are assembled on parade with their arms in hand.

**Army**—An organised and disciplined force of armed men raised for military service, and employed for purposes of national defence; it is commanded by a chief or leader, with officers of all ranks in subordination to him. Modern European armies consist of the following arms: artillery, cavalry, engineers, and infantry. The relative proportion of each arm varies, within certain limits, in different armies. An army permanently maintained constitutes the standing army of a country, and is commanded by a general officer whose title is that of commander-in-chief. In the field it is primarily divided into *corps d'armée*, comprising all arms, each under a marshal or general officer; each *corps d'armée* is subdivided into divisions, which may or may not comprise all arms; and divisions into brigades. The strength of a *corps d'armée* depends on the capability of the nation to furnish men, and the nature of the operations. In the French and Prussian armies, the strength of a *corps d'armée* is from 30,000 to 40,000 men, or even more. The strength of a division varies similarly, according to circumstances. A brigade consists of two or more regiments of the same arm, and is subordinate to a divisional command, and commanded by a brigadier-general. The foregoing, as explained, gives the divisions into which an army in the field is told off, the aggregate forming the main army assembled for the operations in view. From the main army are detached such portions of the force as are necessary for operations in which the whole army would not be employed.

An army in the field, to be effective, requires to be completely equipped with ordnance, commissariat, engineer, medical stores, and the means of transport. The supply of these concomitants of an army in the field demands the services of regularly organised departments, on the efficiency of which the success of the operations undertaken by the army greatly depends. The standing army of a country is supplemented by reserves, and in England by the militia and the volunteer forces as well.

A question of great importance in the formation of an army, but which has never been universally agreed upon by European nations, is the proportion of guns to men. The continental powers seem to have followed France in laying down the proportion of 3 to every 1000 men, but this number has constantly been changed, so that it is difficult to say what the proportion is. The number depends on several circumstances, such as the strength of the army, the country it has to pass through, whether a flat open country or mountainous. Each nation appears to have its own idea as to what should be the proportion. From the works of recent writers, as shown in the 'R.A.Proceedings' (vol. viii. No. 1) of 1872, it is laid down that if the theatre of war be favourable for the movement of large bodies of troops, the proportion of guns to men may be from 3 to 5 guns per 1000 for an army of 30,000, 50,000, or 80,000 men. But with the larger armies, which we see, collected now-a-days on the continent, amounting to a million and upwards, a diminution of guns may well take place, even below 3 per 1000, as a larger proportion of artillery is very cumbersome, and impedes the movement of an army. Moreover, any excess of what has usually been laid down would under most circumstances be valueless; the guns in rear of the column of march being unable to be brought into action, at the time the head of the column is engaged, without the country admitted of large deployments. A *corps d'armée* takes up on the line of march from twenty to thirty miles. It will therefore be readily understood that it would be difficult to get the whole of the artillery into position to take advantage of an action going on ahead. Further, the artillery of an army is the branch that occupies so much ground on the march; a battery of artillery alone taking up 473 yards of ground in column of route, hence the great impediment to speedy or advantageous movement; indeed an army is hampered by too large a force of artillery.

Large armies move naturally very slowly; if actually marching, the rate may be stated at from one to two miles an hour, and even this rate is dependent on the state of the roads and other circumstances; to be hampered therefore with a large number of guns would be to impede the column of march. As far as can be ascertained, the number of guns to men in the French army during the late Franco-Prussian War was under 3 to every 1000 men, and in the Confederated German army under 2 guns per 1000. (*Vide* Appendix C.)

**Army Hospital Corps**—A body of men recruited from the ranks of the army for the purpose of looking after the sick and wounded, and for carrying out such instructions as may be given to them by the medical officers with reference to diet and treatment, and in administering of medicines ordered, and giving such necessary attendance as the sick require. The men act as bakers, cooks, and perform all duties which render them useful to the patients.

**Army Hygiene**—Is a branch of the Medical Department having for its object the sanitary condition of the army, whether in quarters or in the field. *Vide* Medical Department.

**Army Reserve**—A force, under the present organisation of the British army, composed of men who have enlisted for twelve years, a portion of which service, viz., six, and not less than three years, must be passed with the colours, the residue being spent in the reserve. This condition of service is known as "short service." Other soldiers are eligible to enter the reserve force, viz. those who have exceeded the first term of their engagement, say men after thirteen or fourteen years' service, and who do not exceed thirty-four years in age. Under the system which now obtains, a considerable reserve force may be expected to be formed, and it is estimated that with an army of 180,000 men, of whom three-fourths are to serve only six years with the colours, there will accrue by 1882 a large reserve of trained men, all under thirty-two years of age.

The Army Enlistment Act of 1867 formed a body of men called the enrolled pensioners and others into two classes:

1st class, not exceeding 20,000 men, liable for service anywhere, and consisting of men who are serving or have served in the army, and whose service does not exceed first term of enlistment.

2nd class, not exceeding 30,000, liable for service in the United Kingdom only, consisting of persons already enrolled, out-pensioners.

The Act of 1870 has modified the above, and the result has been that enrolment for 2nd class, except for pensioners, has been suspended. (2nd class therefore consists entirely of enrolled pensioners, who are called out for twelve days annually, under S. O. of Pensioners, and number about 15,000.) Enrolment in the 1st class is encouraged, and men are eligible to enter this class up to the age of thirty-four; the retaining fee amounts to £6 per annum (but no claim to future pension), and all men enlisted under short service are to be passed into this class, who will ultimately be the reserve of the standing army. (*Vide* Appendix E.)

**Army Schools** or **Colleges**—Establishments of a military nature for furthering the education of officers and men in the acquirement of knowledge adapted to their profession. Such is the Royal Military College at Sandhurst, and the Royal Military Academy at Woolwich, the former, being now intended for young officers on obtaining their commissions of sub-lieutenant, and before joining their regiments, and also for officers qualifying for the staff; the latter, for candidates for the artillery and engineers. Then there is the School of Instruction at Chatham, where officers of the line or cavalry have the opportunity of being instructed in army signalling, surveying, &c.; the School of Artillery at Shoeburyness; the School of Musketry at Hythe; and the Advanced Class of Artillery Officers at Woolwich; as well as the School of Instruction at Aldershot. The institutions under the name of schools are intended for the men as well as the officers.

For soldiers and their children there are garrison and regimental schools, which afford the usual elementary school tuition. The Royal Military Asylum is also an establishment for the instruction of soldiers' sons.

**Army Service Corps**—A branch of the Control Department, officered from the supply and transport sub-department. The officers of this corps rank as follows:—Commissary = major; deputy commissary = captain; assistant commissary = lieutenant. The corps consists of clerks, tradesmen, mechanics, skilled labourers, drivers, &c., who are required for the various duties connected with the supply, store, pay, and transport service.

**Army Signalling**—A system adopted in the army to enable out-posts to communicate by signals with the main body; also to permit officers, &c., who may be patrolling or with reconnoitring parties to communicate readily and speedily to the general what they observe or is brought to their notice regarding the movements of the enemy. The ordinary means used to carry on communication by day is by coloured flags, revolving shutters, and flags waved by hand; by night, coloured lamps and a combination of long and short flashes. In the English army the work is carried out partly by code, partly by the Morse alphabet. This mode of signalling is intended to supplement the electric telegraph, which now always accompanies an army, in case the telegraph should be interrupted.

According to the Queen's Regulations, a certain number of officers, non-commissioned officers, and men, from each branch of the service, has to attend at the School of Military Engineering, Chatham, for the purpose of being instructed in army signalling. Officers belonging to the Indian army are also permitted, if vacancies admit, to attend the classes.

**Arquebus** — An ancient hand-gun, which was cocked with a wheel. It was the first form of weapon which could fairly be compared with the modern musket. The design was taken from the old cross-bow, its name conveying the meaning of "bow with a mouth." In French, the name is *arc-à-bouche*, or *arc-à-bousa*, corrupted into arquebus. On the formation of the English yeomen of the guard in 1485, one-half were armed with the arquebus, which had gunpowder for its motive power.

**Array**—Order of battle, as an army in battle *array*.

**Array, Commissioners of**, *vide* Commissioners of Array.

**Arrest**—In a military sense, implies the suspension of an officer or non-commission officer, for misconduct, from all military duty, until released by superior authority, or, if brought before a court-martial, until he shall have proved himself innocent of the charge. It is directed in the Queen's Regulations that, before bringing an officer to trial, it is necessary that his conduct shall have been previously examined by superior authority, in order to ascertain that the charges are such as should be submitted to the cognizance of a court-martial, and that there is sufficient evidence to substantiate them.

There are two kinds of arrests, close and open, the latter being also termed arrest at large. An officer in close arrest is not allowed to leave his quarters or tent, and to prevent him doing so, if not obedient to orders, a sentry is placed at his door. If he be in arrest at large, he is permitted, with the sanction of authority, to take exercise within defined limits. Open arrest is only applicable to an officer.

**Arsenal**—A place of receipt and issue of guns, small arms, and all other warlike stores. Woolwich is the main arsenal of England, and possesses within its precincts several manufacturing establishments, such as the carriage, gun, and small-arm ammunition factories.

In our great Indian dependency there are several arsenals in each of the presidencies in which the sinews of war are stored, but beyond having a comparatively small workshop attached to each, the Indian arsenals are more places of receipt and issue of such arms, ammunition, and stores, which an army requires in peace or war, than manufacturing establishments. The gun, carriage, powder, small-arm ammunition, and harness factories, are all separate establishments, but they are not situated far from each of the presidency capital towns.

**Arsenic**—A metal of a crystalline appearance, and imported into India from Burmah, China, and the Persian Gulf. It sublimes at 356°, emitting a strong garlic smell during the sublimation. If the process be performed with free access of air, arsenious acid is rapidly formed. The arsenic of commerce is of a white colour; what is used in the laboratory is a sulphuret of arsenic, and is of two kinds—the native yellow sesqui-sulphuret of arsenic, called "orpiment," and the red proto-sulphuret or "realgar." Of orpiment, there are many varieties,—one in fine gold-coloured scales; another in intense yellow stony lumps; a third in earthy-looking masses, called the king's yellow, a familiar paint. For the use to which arsenic is put in the artillery service, *vide* Orpiment.

**Art, Military**—May be divided into two principal branches. The first relates to the order and arrangement which must be observed in the management of an army,—when it is to fight, to march, or to be encamped. This branch is generally known under the name of *tactics*, which signifies order. The second belongs to the other branch of military art, and includes the composition and application of warlike machines.

**Articles of War**—Rules and regulations for the better government of her Majesty's forces at home and abroad, which the sovereign is empowered by the Mutiny Act to make and institute, under her sign-manual. This privilege has been annually re-enacted, and annually exercised by the crown since the reign of George III. to the present day. As the Articles of War are read at the head of every corps in the service, once in three months, no officer or soldier can plead ignorance of these articles as an extenuation of misconduct. Moreover, commanding officers of regiments are directed to see that officers are well acquainted with the Articles of War, by frequently examining the officers under their command, more particularly the subalterns.

The Mutiny Act and Articles of War for the time being, tempered by the regulations issued from time to time by the sovereign, form together the code of laws which governs the British army.

**Artillery**—The name given to ordnance of all natures, and the arm of the service to which it is attached. The term artillery comprises also the art of manufacturing every nature of gun-carriage and ammunition, as well as the mode of preserving and making use of them. Besides comprising the *matériel*, it includes also the *personnel*, of that arm.

The origin of the word artillery is of very ancient date, and meant formerly a very different arm to what we are accustomed to associate that name with at the present day. Arrows were anciently called artillery; thus we read in Holy Writ that Jonathan, when he had shot his arrows as a signal to aim, gave "his artillery unto his lad." Further, we observe that, before the introduction of gunpowder, our ancestors used, under the name of artillery, machines termed the balista, catapult, and battering ram, which projected stones for battering down the lofty walls and towers forming the defence of many of our old towns. On the introduction of gunpowder, guns termed "bombards" were manufactured—rude specimens of the art as compared with later introductions—they were at first principally hand arms, weighing from 25 to 30 lbs., but were subsequently increased in size, and termed "cannons."

The first guns were built up with

wrought-iron bars or plates, strengthened with rings of the same material; they projected stones, and were fired from the ground, or from rough wooden beds, which served as carriages. By degrees, and after some centuries, the calibres of ordnance were enlarged, and brass guns introduced, as early as the fifteenth century, towards the close of which gun-carriages with wheels were manufactured in France, showing what great strides had already been made in all matters pertaining to ordnance. This progress continued through the following centuries, when, in the eighteenth century, a foundry was established at Carron, in Scotland, where carronades were first made, and which gave the name to this nature of ordnance. At this foundry, as well as at Lowmoor, in Yorkshire, most of our cast-iron guns were manufactured.

The days of cast-iron guns, at least in the British service, may be said now to have passed away, these arms being superseded by rifled ordnance, though there are still a few heavy guns of this nature in use.

The *matériel* of the British artillery is divided into three classes—siege, garrison, and field; comprising guns of all calibres, from the 38-ton 12½-inch rifled gun (700-pr.) to the 7-pr. mountain gun, including heavy rifled howitzers and mortars.

The *personnel* of the regiment, since its amalgamation with the artilleries of India (which took place in February 1861), comprises a body of about 35,000 men of all grades, consisting of 31 brigades, viz. 6 of horse artillery and 25 of garrison and field, with a depot and a coast brigade.

The field brigades consist in the aggregate of 114 batteries of 6 guns each; these include the total of light artillery, horse and foot, in the service at home and abroad. The brigades of horse artillery consist each of 5 batteries, and the field brigades of 7 batteries each.

**Asphaltum**, or **Asphalte**—Is described as a bituminous substance somewhat allied to coal in its properties, and probably in its origin and mode of formation. It is exceedingly inflammable, readily softened by heat, and more or less soluble in alcohol, ether, and oils. It is employed in admixture with hard mineral substances, and with pitch as a material for paving and covering roofs and floors. A black enamel varnish is also made of asphalte.

**Assault**—An attack of a fortified work, either by escalade or on the breach being reported practicable. Previous to assaulting a place, all precautions must be taken to form "storming parties," "supports," and "firing parties." In an escalade, ladders form the means of aiding the assaulting party in getting into the works attacked. The firing party, supported, if possible, by artillery, is spread out in extended order, ready to keep down the fire of the besieged whenever a soldier shows his head above the parapet; further, by its fire into the embrasures, to disable the artillerymen at their guns. The ladders used are 26 and 14 feet, in two pieces, though ladders of 40 feet are used. (*Vide* Appendix D.)

**Assault of Arms**—Military exercises, comprised in the use of the broadsword, small sword, bayonet exercise, and fencing.

**Assembly**—The second beating of the drum before a march, at which the men strike their tents, roll them up, and stand to their arms.

**Assize of Arms**—A law enacted in the reign of Henry II. which enjoined every able-bodied man in the realm to maintain arms, suitable to his rank and condition of life, at his own expense. Of this law our militia is the modern offspring, and there can be no doubt that it is incumbent on every British subject now, as it was in earlier times, to give his service when required in defence of his sovereign and country. The enforcement therefore of the ballot in the militia would be no hardship.

**Atlas Metal**—The metal used in the manufacture of the cases of Hale's rockets and Boxer's life-saving rockets. It is a mild steel produced by the Bessemer process.

**Atmosphere**—Is described as the general term applied to the whole gaseous portion of the earth. Being much lighter than either land or water, it floats or rests upon either, and rises to the height of probably forty or fifty miles above the level of the sea. It consists essentially of two gases, oxygen and nitrogen. One hundred parts by weight contain 77 parts nitrogen and 23 parts oxygen, or by measure 79·19 nitrogen and 20·81 oxygen.

The atmosphere is measured by a column of mercury of 29·922 inches, which has been adopted in France as the mean height of the barometer at the surface of the sea.

**Atmosphere, Pressure of**—The weight of the atmosphere with a barometric pressure of 30 inches, which is equivalent to 14·09 lbs. on the square inch.

**Attack**—In a military sense, means an assault upon an enemy, with the view of driving him from his position. An attack may be made either in the open field or against a fortress; in the latter case, if the enemy holds out, a regular siege has to be carried on by means of trenches, saps, galleries, &c. In attacking a position, a false attack is sometimes made at the same moment with the real attack, to divert the attention of the enemy, and to make him divide his forces.

**Attention**—A cautionary word used in the British army, preparative to any particular exercise or manœuvre.

**Auget** — A wooden trough for the saucisson of a mine.

**Austrian Army**—One of the four great continental armies of Europe.

In December 1868, the imperial signature was affixed to the law introducing the system of obligatory personal service for every male subject of the Austrian empire. At present, the military force of Austria is composed of—

The standing army,
The reserve,
The Landwehr,
And the Landsturm.

The latter element means simply a *levée en masse* of the entire male population for the defence of the country in case of invasion.

The total liability to military service extends over twelve years, this period being thus apportioned:—

3 years to the standing army,
7 ,, ,, reserve,
2 ,, ,, Landwehr.
—
12

In countries that have adopted the compulsory service, exemptions are obtainable under the following social conditions:—

1. Being the only son and support of a helpless father or widowed mother;

2. After the death of a father, being the only grandson and support of an infirm grandfather or widowed grandmother;

3. Being the only support of helpless relations.

All service of a substitute, or exemption by purchase, is abolished. As in Prussia and France, volunteers for one year are admitted.

The effective numerical strength of the standing army, reserve, and Landwehr, amounts to about 1,100,000 men, of which about $\frac{8}{11}$ are contributed by the first two classes, the standing army and reserve, to which Hungary furnishes a quota of nearly 330,000.

Austria, inclusive of Hungary, is divided into 17 military districts. The standing army is composed of 24 divisions, containing 52 brigades of infantry and 19 of cavalry. The infantry of the line consists of 80 regiments; the cavalry of 41 regiments (14 of dragoons, 14 hussars, and 13 lancers) giving about 36,000 cavalry men.

The artillery consists of 12 regiments of field and 12 battalions of garrison artillery, each field artillery regiment consisting of—

4 4-pr. foot batteries,
3 4-pr. horse batteries,
5 8-pr. foot batteries.

In the Austrian army, to every 1000 combatant foot soldiers, there are 103 cavalry and 4 field guns.

There are 2 regiments, of 5 battalions each, of engineers, with 4 active and 8 reserve companies, and one depot battalion of 5 companies.

The transport service of Austria is conducted by a military transport corps, which consists of 36 field squadrons, 22 of which on mobilisation are assigned to the infantry divisions, 5 to the cavalry, 4 to army corps head-quarters, and 2 to general head-quarters. There are, besides, the intendance and a hospital corps.

The emperor is the supreme head of the Austrian army, which he governs through a minister of war and an inspector-general. The mode of officering the Austrian army is as follows:—

1. By passing, as a cadet, through a military college;

2. Rising from the ranks.

1. Cadets are trained at public cost, and remain ten years in active service from the date of their leaving the academy. After the aspirant has practically learnt every duty of the private and non-commissioned officer, he attends the school which is established at the head-quarters of every division. He goes then through a course of eleven months, followed by an examination. If successful, he performs the duties of an officer, though still not commissioned, and receives his commission when a vacancy occurs.

2. The preparation for promotion is also regimental, and in this manner non-commissioned officers of good character and antecedents, and of sufficient attainments, may obtain a commission.

Promotion goes right through, arm by arm, and rank by rank. It is by seniority and non-seniority. The former depends on the confidential reports giving testimony of the individual's efficiency, and the latter is followed every sixth step below field rank, and every fourth step above it. There is an examination twice a year for promotion. (*Vide* Appendix C.)

**Austrian Field Gun**—A muzzle-loading rifled gun made of bronze. There are two sizes, the 4-pr. and the 8-pr.; the former for horse artillery, the latter for field batteries. The projectiles are iron-ribbed, not studded, for taking the rifling. The Austrians are about to change their bronze guns for steel of their own design; the proof lately of one of their guns answered all that was required of it. The gun experimented on was an 8·7-centimetre steel cannon, and is said to be an improvement on the Prussian field gun.

**Auxiliary Forces**—The militia, yeomanry, and volunteers of Great Britain form what are termed the Auxiliary Forces. (*Vide* Appendix E.)

**Axe**, *vide* Battle-axe.

**Axe, Felling**—An implement used for felling trees and jungle, and attached to field batteries for clearing any impediments in their march.

**Axis**—In gunnery, the axis of a gun is an imaginary line drawn from the breech to the muzzle. It will be better understood by imagining a gun supported in the lathe at its two extreme points, when a line drawn between these points will represent the axis of the piece.

**Axle-tree**—A transverse beam supporting a carriage, and on the ends of which the wheels revolve. Lieut.-Colonel Owen, in his 'Modern Artillery,' states that "axle-trees are, like wheels, divided into four classes, named, respectively, *siege*, *field*, *general service*, and *naval service* axle-trees; each class contains several natures of axle-trees, but all those in a class have *arms of the same size*, and only differ in the amount of metal between the arms; the similarity in the arms allows of an interchange of wheels when required."

**Axle-tree Arm**—That part of the axle-tree which enters into the nave of the wheel. It tapers from the shoulder to the end of the arm. For information on the friction of axle-tree arms, *vide* Friction.

**Axle-tree Bed**—In an artillery carriage, the wooden or iron bed into which the axletree is firmly fitted. In the wooden gun carriage, the axle-tree bed is secured by bolts passing through the block trail. It is further fastened to the brackets of the carriage by the axle-tree band, which passes under it, and also by bolts passing through the brackets, two of which have eye-pins, and fasten on the cap squares. A wrought iron axle-tree bed has been substituted for the wooden bed in the 9-pr. and 16-pr. M.L.R. carriages, and it is likely to supersede the present service pattern in future manufacture, as will be seen from the following extract from Captain Kemmis's paper on the 'Construction of Field Artillery Carriages':—

"The wooden axle-tree bed, hitherto used, served as a convenient means of securing the axle-tree to the carriage body, more particularly in wooden gun-carriages; it also distributed the load in travelling, and the strain in firing, more uniformly over the axle-tree, serving by this means, and by its own additional strength, to admit of the axle-tree being made lighter than it otherwise could be.

"In iron carriages, however, it gives

no additional facility of construction, and though it has the advantage of assisting the axle-tree to some extent, it is a questionable advantage; so that in this case it would appear to be a superfluous and it may even be said to be a faulty form of construction—a compound axle-tree as it were, being made of two substances differing so much in elasticity as wood and iron, and further, the material having the greatest elasticity placed to receive the pressure or blow; in fact, the iron may be broken before the full strength of the wood has been called into play. For this reason it is probable that in iron carriages of the future it will be dispensed with, and the axle-tree modified."

**Ayenee** (*Artocarpus hirsuta*)—A tree which grows in the forests of Southern India, Godavery, and Burmah; the wood is strong, tolerably close, even-grained, and of a light yellowish colour. It is a wood that may be used for gun-carriage purposes.

## B.

**Babool** (*Acacia arabica*) — A tree which is found in different parts of India. The wood is close-grained and tough, of a pale red colour, inclining to brown. It is used in the gun-carriage agencies of Madras and Bombay for naves and felloes of wheels. This tree, which grows in abundance in the north-west of India, forms the staple food of the camel.

**Badge**—An honorary distinction worn on the colours of a regiment. The Queen's Regulations direct that all regimental badges granted under special authority to different corps are to be strictly preserved. The term is also applied to the royal arms mounted on pieces of ordnance. The good-conduct stripes worn on the arm by men of good behaviour are also called badges. (*Vide* Good-conduct Badges.)

**Baggage**—In a military sense, includes the clothes, camp equipage, and cooking apparatus of a regiment or army. The baggage of troops, if proceeding by sea, is divided into "light" and "heavy" baggage. This division of terms is necessary to express the nature of baggage to be embarked and the time of embarking it. "Light" baggage is anything that can be taken in the hand, such as clothing and light articles, and which can be taken on board on the day of embarkation; whereas "heavy" baggage is sent on board the day before when feasible. On the movement of troops on home service, the baggage, if wagons are available, is carried by the army transport; if not, then the commanding officer has power by the Mutiny Act to impress the carts of the country to convey the baggage to or from the barracks, to the railway or place of embarkation.

In India, before the introduction of railways, the baggage of troops was conveyed, and is even still, where there are no railways, by the native carts of the country, or on elephants and camels, sometimes on bullocks, according to the part of India in which the troops might be moving. In the north-west of India, elephants and camels (when off the line of railway) are almost exclusively used; in other portions of the country, carts; but along the line of railroad, advantage is taken of it for the transport both of troops and baggage, except for cavalry or batteries of artillery, which in time of peace invariably march. Carts vary in size in different districts, and are drawn by two, three, or four bullocks. A four-bullock hackery, which in the north-west of India is generally the size used, will carry 1600 lbs., or 400 lbs. to every bullock. An elephant can carry about 1200 or 1400 lbs. in a flat country, and a camel 320 lbs., without being distressed.

**Baggage-master**—An officer appointed to take charge of the baggage of each brigade and division of an army in the field. He is selected from the line if the senior officer of the Army Service Corps is not suited for the work. During the march he is the staff officer of the field officer of the day, who, commanding the rearguard, can give him orders if necessary. The Queen's Regulations of 1873, sect. 16, par. 24, state that each regiment on a march is to furnish its own baggage-guard, under the care of an officer of the regiment.

**Bagpipe**—A wind instrument, very popular in the Highlands of Scotland.

This instrument, the performers of which are called "pipers," is played by the bandsmen of Highland regiments. Up to the eighteenth century, the bagpipe was a very common instrument over the greater part of Europe. It is supposed to be of Grecian origin, and the Romans in all probability took it from the Greeks. The natives of India have an instrument very similar to the bagpipe. The bagpipe has long been a favourite instrument with the Scots, inspiring them with great enthusiasm and valour in the day of battle.

**Bags**—In the military service, are used for a variety of purposes; but their number is so infinite that space will not permit of their being all given in detail in this work.

**Bags, Blowing**—Bags filled with a small charge of gunpowder and coal dust, and placed inside a common shell, when it is not intended to burst the shell. The charge is ignited by means of a fuze. Blowing bags are used at artillery practice, to show where, if the shell had been a live shell, it would have burst.

**Bags, Bursting**—Bags for the bursting charges of common shell. In order to prevent the liability to occasional premature bursts, when firing filled common shells from M.L.R. guns of 7-inch calibre and upwards, it has been found necessary to inclose the bursting charge in a serge bag.

**Bags, Calico**—This nature of bag is used in and attached to the interior of metal-lined and brass pentagon cases, for the preservation of loose powder in a damp climate when it cannot be preserved in ordinary barrels.

**Bags, Cartridge Waterproof**— Are waterproof bags for holding small-arm cartridges when despatched to foreign stations. They are made of waterproof cloth. Cannon cartridges are packed in waterproof paper when specially asked for.

**Bags, Gunny**—Are bags made of coarse gunny cloth, and used in India with siege-trains for carrying charcoal, for the use of the artificers.

**Bags, Gunpowder**—Are bags made of serge or other cloth, and used for blowing open gates, stockades, &c. The size of the bags differs according to the charge intended to be placed in them; they are fired generally by means of a Bickford fuze. The bags are either placed on the ground or fastened by a hook to the gate. In Burmah, in 1852, experiments were made to test the value of powder bags in blowing down stockades, and the result proved most satisfactory; bags containing about 50 lbs. of powder causing a rent large enough to admit of a section of infantry entering within the enclosure. Experiments were also at the same time made with 8-inch howitzers, which failed to make much impression on this mode of defence. The Indian water-carriers' *mussuck*, or water-bag, can be used as a powder-bag on an emergency.

A late report on gun-cotton shows this material to be most effective in blowing down stockades, and indeed for many of the purposes for which gunpowder has hitherto been used.

**Bags, Sand**—Bags made of coarse canvas, tarred or untarred; they are filled with earth, and used for revetting the interior slopes of field works, and to give cover to riflemen firing over a parapet; they are also used for other general purposes.

**Bags, Serge**—Bags made of serge cloth and used for the bursting charge of rifled M.L. common shells, and for the bursting charge of Palliser shells from 7 inches to 12 inches.

**Bags, Soldiers'**—Bags of two kinds, painted and unpainted, and made of canvas or vitry cloth. The painted bag contains the soldier's kit for the march, and is carried with the baggage. The unpainted, or haversack, is slung over his shoulder, and is used by the soldier on the march to carry extra rations, or any spare articles he may have in his possession.

**Bakeries, Military**—As the name implies, are means adopted for baking soldiers' bread. At Aldershot, military bakeries have been introduced for some years past, whereby a saving of expense has resulted. Not only at Aldershot, but at the Curragh, Dublin, Chatham, and Shorncliffe, bakeries are established, worked by soldiers, under the direction of the Control. At other stations the supply of bread is carried out by contractors. The training of bakers for the army in the field is organised at the above-named places. The foregoing relates to permanent ovens in a standing camp. When troops are in the field, field ovens are used; they are of three kinds, baking wagons, sheet-iron field ovens, and extemporised ovens of clay, stones, &c. All have been found to work admirably, and to afford large results, even more than is required of them. Of baking wagons, the smaller-sized one is that used with all flying columns, &c.; it can bake eight batches of 210 lbs. a day. Of iron field ovens, commonly carried in the field, there are different patterns, and that termed the common pattern bakes 150 lbs. at a time. The Aldershot pattern oven bakes over 200 lbs. in a batch. During the Crimean War a bakery ship was fitted out which baked 18,000 lbs. daily. Bread is usually baked in 1-lb. or 3-lb. loaves for field service.

The Prussians attach so much importance to bakers being up with the force that they are attached to the advanced guard. The Austrians, in the war of 1866, were often greatly inconvenienced on account of their bakeries and ovens not being up with the troops.

**Baldric,** *vide* Baudrick.

**Balista**—A machine used by the ancients before the invention or introduction of gunpowder. It projected masses of stone to a distance of 90 yards. Darts and arrows were also thrown from the balista.

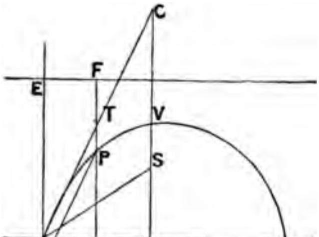
**Ball**—The collective name given to all kinds of shot and bullets. It is also explained as any round substance of iron or lead discharged from cannon or small arms. The first balls for cannon were generally made of stone. Cast-iron was subsequently used, of a spherical form. Since the introduction of rifled cannon, oblong shot are projected from this nature of ordnance.

**Ball Cartridge**—Ammunition used with the several natures of small arms in the service; for the Martini-Henry rifle the cartridge contains 80 grains of R.F.G.$^2$ powder, and the bullet weighs 410 grains. The Snider or converted Enfield rifle cartridge contains 2½ drs. of R.F.G. powder, and the bullet weighs 480 grains.

**Ballistic Pendulum**—This was formerly the instrument used in testing the strength of gunpowder in order to ascertain the velocity of projectiles. It is unnecessary to describe it, as it has been superseded, advantageously, by Navez Leurs's ballistic apparatus.

**Ballistics**—The science of the motion of projectiles. By this science all problems that can be imagined with reference to the flight of spherical and oblong shot or shell are resolved. It is divided into two distinct parts, according as to whether the projectile is supposed to fly through empty space, or through the resisting medium of the air. The calculations, based on the former hypothesis, are found to tally with the results of practice with shells of large calibre fired with small initial velocities, and consequently short ranges. The trajectory is supposed to be a parabola, and the curve of the actual trajectory of shells fired under such circumstances, or of the steel ball of the eprouvette mortar, differs but little therefrom; when the velocity increases, on the other hand, the formulæ of the parabolic system have to be altered by certain co-efficients, which have to be calculated in each case, and this can be done with great ease, with the assistance of the published tables of the French artillery by General Didion. Problems worked out with these altered formulæ give results approaching so closely to those of actual practice as to leave but little to be desired.

The following is the method of calculating the path of a projectile *in vacuo*:—



### (i) *The Path.*

Let A be the initial position of the particle; P its position at time $t$; $\phi$

the $\angle$ of projection; and V the initial velocity.

Then, with the above construction,

$$AT = Vt \quad \text{and} \quad TP = \frac{gt^2}{2}$$

$$\therefore\ PM = Vt \quad \text{and} \quad AM = \frac{gt^2}{2}$$

$$\therefore\ \text{Eliminating } t \quad PM^2 = \frac{2V^2}{g} \cdot AM$$

∴ the path is a *parabola*, as in the figure, and $AS = \frac{V^2}{2g}$.

(ii) *To find* AB *and* BS; i.e. *the Focus.*

$$\angle\ SAB = 90 - 2\,TAy = 90 - 2(90 - \phi) = 2\phi - 90$$

$$\therefore\ AB = SA \cos(2\phi - 90) = \frac{V^2}{2g} \sin 2\phi$$

$$\text{and } BS = -\frac{V^2}{2g} \cos 2\phi \text{ similarly.}$$

$$\text{Hence } \textit{Whole Range} = \frac{V^2}{g} \sin 2\phi.$$

(iii) *Time of Flight.*

At V, the vertical velocity,

$$V \sin\phi - gt = 0 \quad \therefore\ t = \frac{V \sin\phi}{g}$$

$$\therefore\ \text{time of flight} = \frac{2V \sin\phi}{g}.$$

(iv) *Height ascended.*

$$BV = BC - CV = AC \sin\phi - \frac{gt^2}{2}$$

$$= Vt \sin\phi - \frac{gt^2}{2} = \frac{V^2 \sin^2\phi}{2g}.$$

(v) *Velocity* at any point ($v$ say).

The vertical velocity being $V \sin\phi - gt$, and the horizontal . . $V \cos\phi$.

$$\begin{aligned} v^2 &= V^2 - 2Vgt \sin\phi + g^2t^2 \\ &= 2g\left\{\frac{V^2}{2g} + \frac{gt^2}{2} - Vt \sin\phi\right\} \\ &= 2g\,\{SA + TP - TN\} \\ &= 2g\,(AE - PN) \text{ if EF be the directrix,} \\ &= 2g\,.\,FP. \end{aligned}$$

Hence the velocity is that which would be acquired *in falling from the directrix.*

The discussion of the path in a resisting medium is too complicated to admit of much abridgment, and the reader is therefore referred to Sandemann's dynamics of a particle on this subject.

**Balloon**—A hollow silken vessel filled with gas (hydrogen), which, being lighter than air, causes the balloon to ascend. Balloons of a large size are used for scientific and military purposes. Messrs. Glaisher and Coxwell made several ascents in England in 1862 to a height of upwards of five miles, with the view of ascertaining certain meteorological points. It appears, from the description given of their voyages, that the air at the height of five miles is so rarefied as to render human existence precarious. The barometer showed at this height 11 inches, and the thermometer 2° below zero of Fahr.

Balloons are useful in warfare for purposes of reconnoitring, and in the case of a beleaguered city, for keeping up communication with the outside world (*vide* the accounts of ascents from Paris in 1870).

The Prussians are said to have reconnoitred the French position before Metz in the war of 1870 by means of a balloon with telegraph attached, and it is further said that the survey, made with great care, was most successful, and conveyed instantaneously to General von Moltke the true position of the French army at all points, and its movements.

From an account given of the first balloons used for war purposes, it appears that the proposal for employing what were then termed captive balloons was made by the Committee of Public Safety in 1793. After some preliminary experiments at Meudon, a small corps of aërostats, skilled in precarious crafts, was formed on the model of an engineer company, and despatched to Manberg, then besieged by the Dutch and Austrian troops. The balloon used was 30 feet in diameter, and rose 1800 feet with two observers and 130 lbs. of ballast. It was managed by two ropes attached to the net, and was filled with hydrogen, obtained with much difficulty and expense from water. The immediate moral effect upon the enemy of the use of this balloon by the besieged was extraordinary. They imagined, which was far from being the case, that their every movement was at once made patent to the French, and it was this that in a great measure caused the demoralised Austrians to abandon the siege. The balloon, passing from a defensive to an offensive position, was then transported while inflated to Charleroi, which the French were attacking. Its apparition at once deprived the besieged of all confidence in their strength, and hastened the surrender of the town while still efficient for defence. The balloon was subsequently used at Fleurus, where much is attributed to it; then at Brussels, Liége, Aix-la-Chapelle, on the Rhine, and on the Danube.

A corps of aërostats accompanied the French army to Egypt, but did nothing, as the apparatus was damaged on the way. In 1800 both corps were suppressed. The Prussians used ballooning against the French in 1812, but the results were not encouraging. At Solferino, one of the brothers Godard ascended in a montgolfier; but he was much too late, and the ascent was all but useless. In the American war, balloons were used from time to time, but were attended with no advantage.

The following are the results of experiments made at Woolwich a few years ago in reference to war or captive balloons, inflated at the Royal Arsenal gasworks. They are thus described in one of the public journals of the day :—

"It has been found that a height of 100 fathoms, at a horizontal distance of 600 fathoms from the enemy, would enable the observers to secure the widest expanse of view. With captive balloons it has been found that they attain stability, and remain like a kite, at rest, when the horizontal resultant of the ascensional force and the tension of the cord are equal to the force of the wind; and this enables a second diversion of science to come in and lend its aid in the time of war. The war balloon having, by a mathematical rule, taken a stationary position, eight cameras and lenses spread round the balloon at equal distances, enables a complete view of the surrounding country to be photographed, and subsequently examined at leisure. The inclination and length of the cord to keep the balloon in the same stratum of air was found to be easily calculable, subject to the inequality of gales of wind and their change of direction. The Woolwich balloons were held by two new cords, fastened to the network, and terminating at two different points on the ground, which gave greater stability to the balloon, and provided against one cord snapping or being cut by the enemy's fire. Under the old plan, aëronautic correspondence was carried on by the explorers in the balloon car being provided with white pasteboard tubes, formed like cartridges open at both ends, to which a bullet was securely fastened. Each piece of intelligence was written in pencil in large characters along the major axis of the paper tube or cartridge, which was immediately despatched by passing the end of the small cord through it, and it was thus precipitated by the gravitation of the bullet into the hands of the expectant general. This plan has just been abrogated by a third diversion of science being brought to bear in the time of war. By the new system of military telegraphy for field service, and by means of the wagons at present being placed in store in the Royal Arsenal, lines of telegraph can be carried through the air from *terra firma* to a balloon several miles distant. The wire can be paid out as fast as the balloon travels, so that if a captive balloon should break or soar away, communication could be kept up with it for six miles, or two or more balloons can be sent."

**Bamboo** (*Bambusa*)—A genus of grasses, of which it is the most gigantic; it is well known for its great economical importance. It is found in all tropical climates, and the purposes to which it is applied are so numerous that it would be difficult to point out an object where strength and elasticity being requisite, and lightness no objection, to which the stems are not adapted in the countries where it grows. When ripe and hard, it is converted into bows, arrows, quivers, lance-shafts, poles of palanquins, poles for tents, fire and escalading ladders, and used in the flooring and supports of rustic bridges. In an artillery park in India, wherever the bamboo can be procured, it is made use of in carrying heavy weights, such as ammunition boxes, shot or shell when carried in slings, and for a variety of other purposes.

**Band**—Anything bound round another. A name formerly given to a company of soldiers.

The word is now usually applied to the body of musicians attached to each regiment. As stated in the Queen's Regulations, a band of music is essential to the credit and appearance of a regiment, and every officer (married or single) has to pay for its maintenance. A regimental band consists of one bandmaster, one sergeant, one corporal, twenty privates in the infantry, and fifteen privates in the cavalry. In the regiment of artillery, in consequence of its greater strength, the band has increased numbers, and remains always at Woolwich, the head-quarters of the regiment. Bandsmen are liable to serve in the ranks on any emergency.

**Bandoliers**—Small wooden cases, covered with leather, twelve in number, fixed to a belt, each containing a round of ammunition. It used to be worn by musketeers in former days, over the left shoulder, and had attached to it a bag for bullets, and means for carrying loading and priming powder in excess of the number of charges. During the reign of Queen Anne they were discarded for the cartridge case. At the present day sportsmen wear waist-belts with so many detached charges hanging to the belt, which may be considered a kind of bandolier.

**Bandrol**, or **Bannerole**—A small flag. Bandrols are used to convey signals from any particular spot to a saluting battery or other post. Also to mark the position to be taken up by the flanks of a regiment at a review in deploying, &c.

**Bandy**—An Indian name for a Madras country cart.

**Banner**—Formerly, a flag or standard under which the vassals of the lord of a manor united for some common purpose, he being the chief of the troop or company. A banner is also a piece of cloth attached to a pole, and usually bearing some warlike or heraldic device or national emblem. The flag is now obsolete in the army, and such flags as banners are only used for purposes of ceremony.

**Banneret**—A higher grade of knighthood, and bestowed in former days for valour. It was so called from the pennon of the knight being exchanged for the banner. The first banneret knight is said to have been made by King Edward I., and the last by Charles I., after the battle of Edgehill.

**Banquette**—A step of earth about 4½ feet below the crest of the parapet, to enable the shortest men to fire over it with facility.

**Bar Bells**—Used for gymnasia, and are of the following weights: 20 lbs., 35 lbs., and 40 lbs.

**Bar Iron**—Wrought iron, under one of its many forms, the other being round, square, flat, &c. When received from contract, in the government establishments at Woolwich, it is tested as to its adaptability for any particular purpose, and these tests are carried out as shown in the 'Treatise on Military Carriages,' by Captain Kemmis, R.A. One of the tests, for example, is known as the "ram's horn" test, thus:—"A specimen is heated to rather less than welding heat, a hole punched through it near the end, the bar split from the hole to the extremity, and the horns so formed, hammered back until they touch the sides, a second hole is then punched and enlarged until the sides bulge out; if the iron is good the fibre will not break either in punching the hole or hammering back the horns." Flat and square bar iron are tested somewhat similarly. "Bar iron should be able to stand a strain in the direction of the fibre of 22 tons per square inch."

**Bar Shot**—Double-headed shot consisting of two solid hemispheres connected by a bar. This nature of shot was formerly used chiefly in the navy; it is no longer in the service.

**Barb**—The reflected points of the head of an arrow. The armour for horses was formerly so called.

**Barbed** or **Barded**—The name given to the armour which nearly covered the war-horses ridden by men-at-arms during the middle ages.

**Barbette**—An earthen terrace, raised within a parapet, so high as to enable guns to fire over the crest of the latter, and, therefore, with a freer range than when worked at an embrasure. When the barbette is for several guns, the terreplein should be made 4 feet wider on the outsides and rear, to facilitate communication. For a single field gun, the terreplein should be 15 feet × 20 feet; for heavier artillery, 18 feet × 24 feet. In all cases the terreplein should be level, and for guns mounted on field or travelling carriages should be 3½ feet below the crest of the parapet. (*Vide* 'Instruction in Fortification, &c. at the Royal Military Academy, Woolwich.')

**Barbican**—A watch-tower, having a considerable command of view, and admitting thereby of the enemy being seen at some distance. It also implies an ancient fortification placed before the walls of a town, or a defence at the entrance of a bridge; also, apertures made in the walls of a fortress, to fire through upon the enemy.

**Barometer**—This well-known instrument was invented by Torricelli for measuring the weight of the atmosphere, or its pressure on the surface of the globe.

The following, extracted from Weale's Dictionary, will explain the principle on which the barometer is made:—"It is well known that it is owing to the atmospheric pressure that water rises in a common pump after the air has been drawn from the barrel, but that the height to which it can be raised by this means is limited, and does not exceed 30 feet; a little more, therefore, than 30 feet balances the atmosphere. Mercury being twelve times heavier than water, about 30 inches of mercury will also counterpoise the atmosphere.

"The principle of the barometer is simple. If a tube, about 3 feet long, closed at one end, and open at the other, be filled with mercury, and with the open end stopped by a finger, this tube be reversed, and placed upright in a cup partly filled with the same liquid, the mercury in the tube in ordinary states of the weather will descend to 30 inches, measured from the surface of the fluid in the cup, and not much lower. The mercury is sustained in the tube by the pressure of the atmosphere on the surface of the fluid in the cup. Such a tube and cup so filled would, in fact, be a barometer; and if a movable index were added to it, this simple instrument would indicate the changes which take place in the atmospheric pressure.

"When observations are made on land, above the level of the sea, a correction is required for altitude, since the weight of the atmosphere diminishes as we ascend. It is owing to this that we are enabled to determine the height of mountains by barometers.

"The cause of the oscillations of the barometer in a gale of wind was first explained by the late Mr. Redfield, of New York. A quantity of fluid in a cup, put in a rapid circular motion, gives a representation of the form of that portion of the atmosphere which is within the limits of a storm. A whirlwind which sets an extended portion of the atmosphere in a state of rapid revolution, diminishes the pressure over a corresponding portion of the earth's surface, and most of all at the centre of the whirl, where the depth of the compressing column of air will be least."

**Barracks** (Spanish *barraca*, small huts or cabins)—In England barracks are permanent buildings made of brick or stone, and erected by government for the quartering of troops. Barracks in England, where the ground is sufficiently spacious, are made to enclose a large area, for the purpose of exercise and drill. In India, except in a few stations, the barracks are detached buildings, either built in line or in échelon. The latter is considered the more desirable position, as it admits of the air circulating freely among all the buildings. Of late years, and since the Crimean War, great attention has been paid both in England and India to the subject of barracks, both as regards the comfort of the soldier and the sanitary measures to be adopted for the preservation of his health, the latter requiring constant care and thoughtfulness. In building barracks in England, it is recommended by army medical men that each soldier should have a room space of 600 cubic feet, and in India from 800 to 1000.

A visit to Aldershot will show those interested in the soldier's welfare a good specimen of the barracks provided for him. Everything has been done there for the comfort and amusement of the soldier, in providing him with libraries, games, and other means of recreation. The barrack rooms are spacious; each room accommodates twenty-four men, and affords the room space allowed to each man as recommended by the medical department. The Queen's Regulations furnish considerable information on the subject of barracks.

**Barrel**—As described in Nuttall's 'Pronouncing Dictionary,' is "a round wooden vessel, of more length than breadth, bulging in the middle, and closed up at either end." Barrels or casks of various kinds are largely used for military purposes.

**Barrel, Gun**—The cylinder of a gun; more generally applied to small arms, the manufacture of the barrels of which frequently forms a distinct trade to other parts of the gun, the barrel being made by different hands, and sometimes in different establishments. The iron used in the manufacture of musket barrels has a portion of steel in it, or undergoes a process of steeling. Old horse-shoe nails form capital material mixed with steel for gun barrels on account of their toughness from usage. Each barrel, after manufacture, has to be tested, and must receive the Tower mark of its having stood the necessary proof.

**Barrel Piers**—Casks or barrels formed into piers, when no pontoons or boats can be obtained for the purpose of constructing a bridge for the passage of troops across a river.

**Barrels, Powder**—Barrels in which gunpowder is stored. There are three sizes, called *whole*, *half*, and *quarter*, holding respectively 100 lbs., 50 lbs., 25 lbs., of ordinary powder. The whole barrel is capable also of containing 125 lbs. of pebble powder. There is also a barrel in the service termed a *bouge* barrel, which is the size of a quarter barrel, and intended to be used, not for storage, but for holding loose powder for mortars or cartridges in a standing battery. This barrel is distinguished from the ordinary powder barrel in having a leather bag attached to it, which takes the place of one head of the barrel, and is closed by a leather thong. The word *bouge* or *budge* is a corruption of the French word *bouget*, a leather bag.

Powder barrels are composed of heads and staves bound round with copper and ash hoops, and are made by hand or by machinery. The wood used in English barrels is usually American oak, whereas the Indian powder barrels are made of teak, if anything a stronger and closer-grained wood than the oak alluded to, so that it is not found necessary to bind them round with ash hoops, as in the English barrels.

**Barrels, Small-arm**—Barrels for the conveyance and storage of small-arm cartridges. They are of three sizes, *half*, *quarter*, and *eighth*. The half-size is used for blank cartridges, and contains 2000 rounds; the quarter for ball cartridges, 700 rounds of Snider or Martini-Henry ammunition, and the eighth for small supplies. The quarter-barrel is being superseded by boxes.

**Barrels, Stove**—For use in carrying powder in manufacturing departments.

**Barricade**—The term is derived from *barrique*, in allusion to the defences of the streets of Paris during the disturbances of the League. The barricade of a town is formed from any materials, stores, &c., available at the moment, such as palisading, made musket proof by sandbags, chevaux-de-frise, carts, wagons, iron railing, barrels, hampers, or sacks filled with earth to form a parapet. Limbers laid across one another, forming square or oblong cases, the interiors being filled with stones, form a good barricade. A line of wagons drawn across a street, with the wheels on one side taken off, will be a sufficient impediment to cavalry. The object of a barricade is not only protection to people behind it, but to close up openings, streets, &c.

**Barriers**—In fortification, are strong gates, so placed as to defend the entrance of a passage into a fortified place. The gates should be bullet proof and loop-holed. When gates cannot be provided, movable palisades, chevaux-de-frise, or abatis should be used.

**Barrow**—A light hand carriage made of a frame of wood, and carried by two men; or, as in a *wheel-barrow*, a frame with a box supported by one wheel, and rolled by a single man. Barrows are largely used in the army, there being no less than fourteen different kinds put to various purposes.

**Baryta** (BaO)—A compound of oxygen and the metal barium possessing alkaline properties. (*Vide* Chloride of Barium.)

**Bascinet**—A head-piece of mail, over which, in the time of Edward I. and II., the helmet was worn, but in the latter reign the *bascinet* appears without the nasal of the helmet, and occasionally with a movable visor, which rendered the helmet unnecessary. Another form of the bascinet during the latter part of the thirteenth century was its being open behind and having to be fastened or laced behind. (Luard.)

**Base Line**—In military tactics, signifies the line on which all the magazines and means of supply of an army are established. It also means the line on which troops in column move. In surveying, it is the line on which a series of triangles are constructed for the purpose of determining the position of objects and places.

**Base of Operations**—In military language, means the original line on which an offensive army forms, whether it be the frontier of a country, river, or any safe position from which it takes the field to invade an enemy's country. In case of retreat, the base of operations should be kept open to fall back upon. In acting on the defensive, the position must be such as to prevent the enemy from breaking the line and forcing the army away from its base. A base of operations is further necessary to enable the general in command to place his spare food and ammunition which he cannot take with him; also as a safe place for his sick and wounded. It may be any spot as long as it is out of danger, and affords in case of disaster a safe place of retreat. Colonel Macdougall, in his 'Theory of War,' explains that the "base of operations" is "the point, line, or district from which an army starts, and from which all its reinforcements and supplies proceed, when it is committed in a campaign. It may be a single town; it may be a frontier line of any length; or a line of sea-coast, if the army possesses the command of the sea; or it may be a district of a country having breadth as well as length. Whatever be its nature, it must be such that the army retreating upon it, in case of disaster, shall, on reaching it, find succour and safety."

**Base Ring**—In smooth-bored ordnance, the ring which encircles the breech, connected with the body of the gun by a concave moulding, termed the base-ring ogee.

**Bashi-bazouks**—Irregular troops in the pay of the Sultan of Turkey. A body of these men was raised during the Crimean War by the late General Beatson, of the Indian Army, to assist in the operations of the war, but the war was concluded before the men were ready for service.

**Basil**—Tanned sheep-skin, used by saddlers and book-binders.

**Basiliske**—A large-bored gun of great weight, used in the sixteenth century.

**Basket**—The name given to the leather guard round the handle of fencing or single sticks. The leather of condemned pouches is often applied to this purpose.

**Basket Hilt**—The hilt of a sword, so made as to contain and guard the whole hand.

**Bastion**—In fortification, a work generally constructed at the salient angle of the polygon, consisting of two faces and two flanks. The leading principle in the construction of a bastion is, that every part of it should be defended by the flanking fire of some other part of the works. It is composed of a large mass of earth excavated from the ditch, and revetted towards the country with masonry. Bastions are of two kinds, *full* and *empty*. A full bastion is when its interior surface is on a level with the rampart. An empty bastion, when the interior ground is lower than the rampart. The Italians are stated to be the inventors of the bastion system, and though this has been disputed, the Italians seem to have taken the lead in the art of fortification, as in every other. San Micheli, a native of Verona, an architect of great celebrity, was one of the first military architects who made use of the angular or true bastion, if not the actual inventor of it.

**Bastioned Lines**—Consist of bastioned fronts joined to one another. As shown in the work, 'Instruction in Fortification, &c. at the Royal Military Academy, Woolwich,' this kind of trace is considered inapplicable on irregular ground, as the time and labour involved is excessive, and is only recommended for continued lines where the space to be defended is very restricted, and the site is nearly level.

**Baston**—A formidable club which was used as a war-club in the early Norman battles. It was not an unusual weapon at that period, and seems to have been the precursor of the iron mace of the middle ages.

**Bat**—Originally the name of a kind of pack-saddle used for carrying baggage on service; hence, the horse was called a bat-horse.

**Bat-horses**—Baggage horses or mules for carrying officers' baggage on service. The ammunition and regimental stores are also so carried when carts are not procurable.

**Bat-men**—Were originally servants hired in war time to take care of the horses belonging to a train of artillery, battery, baggage, &c. Men who are excused regimental duty for the specific purpose of attending to the horses belonging to officers are also called bat-men or bor-men.

**Batardeau**—In fortification, a wall, 7 or 8 feet thick, which crosses the ditch at the salient angle of the bastion. There is a sluice in the middle and a turret upon the top, to prevent persons crossing. For field works it is composed of piles, planks, &c.

**Bath, Order of the**—As explained in Brande and Cox's 'Dictionary of Science and Literature,' a British order of knighthood. On the day of his coronation, Henry IV. conferred the dignity of knighthood on forty-six esquires, who had watched during the previous night, and bathed themselves in pursuance of a very ancient custom derived from the usages of the Franks. The custom of making knights under the circumstances mentioned was discontinued after the coronation of Charles II., but George II. re-instituted the order. It consists of three classes, G.C.B., K.C.B., and C.B. This order, which is the second order in rank in England, the first being the Garter, is now extended to civil as well as military men. The colour of the ribbon is red for the services, and blue for civilians.

**Baton**—A truncheon or staff conferred upon field marshals as a symbol of authority. The soldiery of Bonaparte, filled with success and with the revolutionary spirit of the age, looked on the highest posts in the republican armies as prizes to be grasped. It has been said, with florid metaphor, that the meanest conscript from a Swiss canton marched with a marshal's baton in his knapsack. The name is also given to the staff carried by the drum-major of an infantry regiment.

**Batta**—An Indian term, implying field allowances, which were granted formerly to troops in India in addition to their regimental pay; this was called full batta. Half-batta was half this allowance, and was paid to officers serving at the presidency towns, and within 200 miles of them—full batta being given to officers beyond that distance. There is no such distinction in name now as half- and full batta in the pay of the officers, though in reality officers of the several staff corps in India only receive half-batta, the difference being made up in their allowances. Officers of British regiments receive full batta wherever they may be.

**Battalion**—A body of infantry of the maximum strength to be efficiently handled and commanded in action by one officer, and considered the tactical unit of infantry. The strength of a battalion is about the same in most armies, viz. a thousand men. In the British service it rarely exceeds nine hundred, and then only when sent on foreign service; the home complement is about six hundred. A body of men of the above strength is commanded by a lieutenant-colonel, and familiarly known to the British public as a regiment. In some of the continental armies a regiment consists of several battalions, and even in the British army many of the regiments have two battalions, one has three, and the rifle regiments four; but they are quite independent of each other, and have each a separate commanding officer and a separate cadre.

**Batter, To**—In the operations of a siege, to fire continuously at a revetment with the object of breaching it.

**Batter**—In fortification, the backward slope of a revetment or retaining wall.

**Batter-head**—The flesh of a drum on which the drummer applies his stick.

**Batteries of Position**—Consist of the 25-pr. and 40-pr. M.L.R. guns. These guns are intended as light siege guns, as well as guns of position.

**Battering Charges**—In the service of artillery there are two classes of cartridges, *battering* and *full.* The first is used with Palliser projectiles, and only under certain circumstances with common shell; the second is the ordinary charge used with common, double, shrapnel shell, and case shot. The powder used would be pebble for all battering charges, and for full charges of 40 lbs. and upwards.

The reason why pebble powder is now used with all large guns instead of ordinary powder is explained as follows: "that the pressure on the gun is much less, and the velocity greater, with the former than the latter. This increased velocity is due to the lower pressure of the powder, which is kept up longer in the bore than with quicker burning powder, the velocity depending upon the pressure and the space over which it is exerted."

**Battering-ram**—Of all the ancient offensive weapons, none, it is stated, were so efficacious as the battering-ram. It consisted of a long pole or spar, headed with a huge mass of iron or brass, usually shaped like the head of an animal, from which its name was derived. The spar was sometimes mounted on wheels, but more frequently suspended by cords from a triangle of stout beams. In either case, the intention was to impel it violently forward against an opposing wall, not with the view of penetrating the mass, or even of dislodging a portion by its immediate shock, but to generate a vibration, which, continually repeated, would shake the strongest walls to their foundation, and eventually bring them down.

**Battery**—Signifies, first, generally, any number of guns grouped and in position for action; secondly, specially, the unit of an artillery command, as a battalion is of infantry, or a squadron of cavalry; thirdly, any work, permanent or temporary, considered merely as a position for a group of guns.

Movable batteries are divided into two classes, *siege* and *field.* The number of guns composing a siege battery, or, as it is commonly called, a siege train, depends on the service it is likely to be engaged in, and all that has been laid down on the subject has been the minimum or unit strength of which a train should be formed, which can be multiplied or increased according to circumstances. The proportion, however, that the several natures of ordnance should bear to each other in a siege train has been fixed, and will be found under the head of Siege Artillery.

Batteries of field artillery are composed of 9-pr. M.L.R. guns, of six guns each, for horse artillery purposes, and of 16-pr. M.L.R. guns for field batteries. Mountain batteries, composed chiefly of 7-pr. rifled guns, are also included under the head of Field Artillery.

Under the third head, viz. permanent or temporary batteries, there are five descriptions, viz. *cavalier*, *elevated*, *sunken*, *half sunken*, and *screen.* A cavalier battery has its platform for the gun carriage above the level of the ground, and is very rarely used. An elevated battery has the platform on the level of the ground. A sunken battery is excavated below the ground line, so that the gun can range just above it. A half sunken battery has both an interior and exterior excavation to furnish earth for the parapet. A screen battery is a parapet of earth running across the front of the batteries and thus forming a screen. As in future sieges a fire of heavy rifled artillery may be expected, such screened parapets of earth will be found to be very protective and of the greatest use—1st, by concealing the battery while it is being constructed; 2nd, by intercepting many shells which would otherwise reach and explode in the parapet of the battery; 3rd, by making it more difficult for the artillery to judge their distance; and, 4th, by supplying a lateral communication between the batteries.

To enable the gunners to direct their guns on the object to be fired at, small openings are made in the screens corresponding with the embrasures of the batteries.

**Battery, Breaching,** *vide* Breaching Battery.

**Battery, Coast,** *vide* Coast Battery.

**Battle**—An action in which the forces of two contending armies are engaged for the accomplishment of some great object. In preparing for the attack certain orders of battle have been laid down as most convenient for the disposition of the troops to be employed, but they vary with different nations, and are subject to the accidents of ground, the position and strength of the defenders, and the object in view. No invariable method of attack can be laid down. Napoleon's general system was to concentrate the mass of his force, and to attack at that point where most decisive success was to be obtained. With the present arms of precision the order of battle and manner of attack would be somewhat modified, as is shown in Colonel Hamley's 'Operations of War' they were, during the Franco-Prussian war; nevertheless, the main principles would be the same as of old, viz.—"that orders of battle or the most appropriate disposition for leading troops into action should possess the inherent qualities of mobility and solidity. To attain these two objects, troops which are to remain on the defensive should be partly deployed and partly in column, sheltered as much as possible by the natural or the artificial advantages, such as shelter trenches and the inequalities of the ground. The corps destined to attack a decisive point should be disposed into two battalions formed into columns, not too deep." The attack should commence with an overwhelming fire of artillery.

The orders of battle as adverted to are reducible to three, each subject to some modifications:—

"First.—The simple parallel order, or that where the hostile forces face each other in parallel lines, to advance or receive the attack. In these, accident or some condition of superiority in courage, artillery, or discipline, decides the contest, and not the capacity of the commanding general.

"Secondly.—Where no other combinations are practicable, there is the second order, or that with parallel lines reinforced upon one extremity. To this class, especially if dispositions with an angle to the front or rear are included, most of the great victories of ancient and modern times may be ascribed; for although it is not the most perfect in theory, it is the most constantly applicable in practice, under almost every possible character of ground or counter-disposition of the enemy.

"Thirdly.—The oblique order of battle is the third and the best class of tactical dispositions; but in the application, great simplicity of combination is necessary, and great prudence in the execution. Against a manœuvring army well commanded, it will always be difficult to apply it; but when produced, the effect is instantaneous and decisive; it is the triumph of discipline and of grand manœuvre."—*Aide Mémoire.*

The following is taken from Colonel Macdougall's 'Theory of War,' on the subject of orders of battle:—"A line of battle may be straight or it may be curved either concavely or convexly towards the enemy. Of these three orders, the convex towards the enemy is best as a general rule, because the flanks, which are the most vulnerable points, are the farthest removed from attack; the enemy, in marching to assail either flank, exposes his own more than if the defenders occupied a straight line. The general disadvantage attaching to this order is that the fire of the position is divergent. Of the two remaining orders the concave is the worst, because the flanks are most exposed to the attack. The general advantages of this order are, that an enemy advancing against the centre exposes both his flanks more than if the defenders occupied a straight line, and the fire of the position is convergent."

**Battle-axe**—A military weapon, not now in use. It was employed from the earliest times by the Saxons. It is stated in the 'Text-book for Musketry' that the battle-axe was used by the inhabitants of Britain upwards of 1100 B.C.; it was then made of flint. When the Romans invaded Britain under Julius Cæsar, 55 B.C., the battle-axe was made of bronze—the change to steel took place shortly after the invasion, viz. in A.D. 78.

It appears to have done great execution in battle in breaking in pieces the coats of mail and steel casques of the Normans. The Lochaber axe is well known as having been a formidable weapon in the hands of the Scottish Highlander.

**Battlements**—The indentures in the tops of old castles and fortified walls, or other buildings, in the form of embrasures, for the greater convenience of firing or looking through.

**Baudrick**, or **Baldric**—The name given to the sash worn by yeomen and by cross-bow men, as well as archers, in the early part of the fifteenth century.

**Baulks**—In pontooning, small beams, the ends of which, bored with bolt-holes, rest upon the saddles between the cleats, to which they are secured with iron-bolts.

**Baume's Flux**—Consists of 3 parts of nitre, 1 part of sulphur, and 1 part of sawdust, as given in Abel and Bloxam's 'Handbook of Chemistry.' This flux is capable of inducing the fusion of different metals, partly on account of the heat evolved by deflagration, and partly because it converts a portion of the metal into a more fusible sulphide.

**Bayonet**—A short sword or triangular-shaped dagger, fitted on to the muzzle of a firelock; in this position the bayonet gives the soldier increased means of offence and defence. The name is said to be derived from the town of Bayonne, in France, where, it is stated, it was first invented. The original bayonet was nothing more than a blade of steel fastened to a helve of wood, which was thrust into the barrel; by this means the musket could neither be loaded nor fired conveniently; to remedy this defect, an elbow and socket were given to it, and the result was the present mode of attaching the bayonet. This alteration took place somewhere about the close of the seventeenth century. The first regiment which appears to have had the bayonet attached to its musket is the Grenadier Guards, so far back as the year 1693. It is stated by Macaulay that in consequence of the awkward mode of attaching the bayonet, the English lost the battle of Killiecrankie, as the Highlanders were upon the troops before they could convert their firelocks into pikes.

**Beaker**—A precipitating vessel made of glass, having a small beak or spout. It is used in chemical operations.

**Beam**—A horizontal piece of iron or timber, used to resist a force or weight; as a *tie-beam*, when it acts as a string or chain, by its tension; as a *collar beam*, when it acts by compression; as a *bressummer*, when it resists a transverse insisting weight.

**Beam**—In steam engines, a large lever turning upon a centre, and forming the medium of communication between the piston rod and the crank shaft.

**Beam Carriage**—In artillery, that part of a gun-carriage included between the breast and trail-point. In the O.P. field carriages, the beam is formed of a solid block of wood, if timber of sufficient scantling can be obtained; but if not procurable, it is formed of two pieces tabled one into the other. In this form it is called a *block-trail* carriage. Formerly, light field carriages consisted of two brackets fastened together by transoms; but this form, though it possessed strength, was found to be awkward and unhandy for quick manœuvring; the block-trail, therefore, was substituted for all light field carriages, and has been also adopted for certain siege carriages.

Since the introduction, however, of wrought-iron guns into the service, the bracket pattern has been re-introduced, and the carriage, which is made of wrought iron, has the brackets and trail in one.

The present pattern of iron carriages is not yet universal in the service, but will be so in the future.

**Beam Scale**—A simple lever, the arms of which are equal. At the end of each arm a scale board is suspended by chains. Scales of this nature were and are still to some extent used for weighing certain stores in the different departments of the army. The mode of eliminating the error in scales is to place the body in one scale and counterpoise it by weights in the opposite scale; then remove the body and replace it by known weights, until the equilibrium is restored. The sum of the latter weights will be that of the body required.

**Bearers, Shot**—Iron carriers used with S.B. guns for bringing hot shot from the furnace to the gun. They are made of wrought iron, and have three handles. Implements used for lifting the heavier natures of rifled projectiles are also termed "shot bearers."

**Bearing**—In carpentry, the clear distance between the supports of a beam.

**Bearing**—In machinery, that part of a shaft or spindle which is in contact with the supports.

**Bearing**—In surveying, the direction of an object with reference to any meridian line, or the angle formed at the point of observation between the meridian line (generally the magnetic) and the object.

**Bearskin Caps**—A military head dress worn by the foot guards. Originally the fusilier regiments wore bearskin caps somewhere about the year 1805.

**Beat of Drum**—As explained in 'Chambers's Encyclopædia,' is a signal or instruction conveyed by a particular mode of drum-beating. It is an audible semaphore, a telegraph that speaks to the ear instead of the eye. There are many varieties of beats known by the names of the *generale*, the *reveille*, the *assembly*, the *foot-march*, the *grenadiers' march*, the *retreat*, the *taptoo* or *tattoo*, the *call-to-arms*, the *pioneers' call*, the *sergeants' call*, the *drummers' call*, the *chamade*, the *rogues' march*, the *long roll*, &c., but many are now in disuse. Some of the same instructions or commands are also given by the bugle, and some by the trumpet.

**Beat a Retreat, To**—Means simply to fall back or retreat before an enemy. Beating the retreat is a beat of the drum at nightfall.

**Beating Orders**—Are instructions or orders given to recruiting parties before they leave the head-quarters of their regiment; they are obtained, on application, by commanding officers from the Secretary of State for War. When recruiting parties are quartered in places where a superintending officer is stationed, they are to deposit their beating orders with him.

**Bed**—In artillery, the frame or rest on which mortars are placed and fired from. Mortars have travelling carriages, which are attached to a limber. In battery the carriage is unlimbered, the wheels removed, and the body laid flat upon the ground. Mortar beds for the larger-sized mortars, viz. the 13-, 10-, and 8-inch land service, are made of iron, and the smaller of wood, viz. the 5½- and 4⅖-inch. Mortars are elevated by means of quoins.

**Beech-tree**—Only one species (*Fagus sylvatica*) is common to Europe. In England, the Buckinghamshire and Sussex beech-trees are esteemed the best. The colour of the wood is whitish brown, of a uniform texture and closeness. It is considered to be almost chemically free from foreign matters. It is used in the manufacture of fuzes, and no wood has yet been found equal to it for that purpose. It is also valuable for wooden types in printing.

**Beegah**—An Indian term. A measure of land.

One beegah = 20 cottahs.

One cottah, or 16 chuttacks = 720 square feet.

**Beffroi**, or **Belfrey**—The name of a movable tower used in the military sieges of ancient and mediæval times. When a town was to be besieged, a movable tower as high as the walls was brought near it; and this tower was the beffroi. It was divided into several stages, in each of which were bowmen, slingers, and the beffroi men; the tower was provided with wheels, which enabled it to be brought into a proper position. It is supposed by some ancient writers that our word *belfrey*, given to a bell-tower, was derived from this warlike machine. (*Vide* 'Chambers's Encyclopædia.')

**Belligerent**—Waging war. Hence any two or more countries at war with each other are termed belligerents.

**Bellows**—An instrument or machine for blowing a fire. There are several sizes of bellows, which are commonly used in arsenal workshops. A portable bellows is attached to each artillery battery forge cart. The principle of the bellows is this, that it attracts or draws in the air by means of a valve, compresses it, and expels it with great force through the nozzle. The larger nature of bellows is formed of upper, middle, and lower boards, which are connected by strong leather; the smaller of only two boards. The valve is situated in the under-board of each, and there is also a valve in the intermediate boards of the larger size, the object of this being to give a continued instead of an intermitting blast, as in small bellows. The larger-sized bellows are driven by steam.

**Belting**—Straps used in driving machinery. They are made generally of buffalo hide, as it is stronger and more durable than any other hide, but there is belting made of other kinds of material. Very good belting leather is manufactured at the government tannery, Cawnpore, in the North-West Provinces of India, and which is used in the government factories in that country.

**Ben** or **Ven Teak** (*Lagerstrœmia microcarpa*)—A tree which grows in the Annamallay Forest in Southern India. It is not so strong or durable as teak. It is used in arsenal workshops in the Bombay Presidency for packing cases, treasure boxes, and other common purposes.

**Bendie** (*Thespesia populnea*)—A wood known on the Bombay side of India, and used in the gun-carriage factory for spokes of wheels.

**Bengal Light**—A blue light, composed of saltpetre, sulphuret of lead, and sulphur, in the proportions of 6, 1, and 2; it is remarkable for its clearness and brilliancy, and can be seen for many miles. It is only issued if specially required.

**Berm**—In fortification, a level narrow space a few feet wide (depending on the nature of the soil) between the foot of the parapet and the scarp of the ditch, to prevent the mass of earth, of which the parapet is made, from sliding into the ditch. In firm soils, the berm may be only from 18 inches to 2 feet wide, but in marshy soils may require to be as wide as 6 feet.

**Besiege, To**—To attack or invest a place.

**Besieged**—Those attacked when shut up within a fortress.

**Besieger**—The attacking party.

**Beton**—The French name for concrete which is used under water.

**Bevel Gear**—In mechanics, denotes a species of wheel-work where the axis or shaft of the leader, or driver, forms an angle with the axis or shaft of the follower to be driven. ' In practice, it is requisite to have finite and sensible teeth in bevel gear. These are made similarly to those of spur gear, except that in the latter they are parallel, while in bevel gear they diminish in length and thickness in approaching the apex of the cone; the teeth are of any breadth, according to the strength required.

**Bevel Wheel**—A wheel having teeth formed so as to work at an angle either greater or less than half a right angle.

**Bevelled Handspike**—A handspike made of wood the end of which is sloped off at an obtuse angle.

**Bheestie**—An Indian term for a water-carrier. The word is derived from the Persian *behisht*, heaven, or delight, probably with reference to the satisfying qualities of water to the thirsty man. Bheesties are attached to all regiments in India, whether in barracks or on the march.

**Bibulous Paper**—Blotting paper, or paper which has the property of drinking in or absorbing moisture. Swedish bibulous paper is the best for chemical filters.

**Bickford's Fuse**, *vide* Fuze.

**Bight**—The double part of a rope when folded, in contradistinction to the ends.

**Bildars**—A name given to a certain class of natives in India, who are entertained as a part of the establishment of a camp or of a siege train on the march, for the purpose of clearing the camp of filth and dirt, or cutting down brushwood in and around the camp.

**Bill-hook**—An intrenching tool used for cutting down and clearing jungle, branches of trees, stuff for gabions, fascines, &c.

**Billed**—A term exclusively confined to the Foot Guards. It means that a man's name is placed in the list or bill of those who are to undergo drill and confinement to barrack. Hence a "billed man," "seven days' bill," "billed up." (Knollys.)

**Billet** — A billet is a document requiring a householder to receive a soldier or soldiers, including officers, with their horses. Only innkeepers and licensed victuallers are liable to have troops billeted on them. They are bound to provide for the accommodation of horses, and to supply them with 10 lbs. of oats, 12 lbs. of hay, and 8 lbs. of straw, receiving for each horse 1s. 9d. per day. In Great Britain a soldier on the march, and during two days' halt at any intermediate place, and for the day of arrival at destination, is entitled to be furnished with a hot meal, consisting of 1¼ lb. of meat previous to being dressed, 1 lb. of bread, 1 lb. of vegetables, 2 pints of small beer, vinegar, salt, and pepper, for which 10d. is to be paid, and a bed, for which 2½d. is to be paid. A soldier billeted in Ireland, and when billeted in Great Britain, except when on the march, is entitled to bed, candle, vinegar, salt, the use of fire, and the necessary utensils for dressing and eating his food. For such accommodation 4d. per diem is paid. Billets are made out by the constable of the parish. (Knollys.)

**Billeting**—The temporary quartering of officers and soldiers in the houses of the inhabitants of any town or village. The Articles of War detail the houses upon which this duty is imposed.

**Billets**—Timber in logs, or in the rough.

**Bit, Boring**—An instrument used in boring out the interior of cast ordnance. In this bit the parallel shaft of the boring bar slides accurately in a groove, exactly parallel with the bore of the gun; the cutting blade is a small piece of steel affixed to the end of the half round block, which is either entirely of iron or partly of wood, and the cut is advanced by a rack and pinion movement, actuated either by the descent of a constant weight, or by a self-acting motion derived from the prime mover. For making the spherical, parabolical, or other termination to the bore, cutters of corresponding forms are affixed to the bar.

**Bit, Bridoon**—The snaffle and rein of a military bridle, which acts independently of the bit, at the pleasure of the rider. This bit has been fitted with one ring, two links, and a spring hook on each side, instead of T's and links as hitherto.

**Bit, Curb**—Two kinds are used in the artillery, one for the mounted non-commissioned officers and detachments of artillery, the other for the harness bridle.

**Bit, Spiral**—A gun implement used for clearing the vents of ordnance when choked, after the gun drift has failed to do so.

**Bits, Bouching**—Instruments used for boring a hole in the vent field of guns, to receive the copper plug, or bouch, through which the vent is afterwards drilled.

**Bitumen**—A name for a number of inflammable mineral substances, known under the names of naphtha, mineral tar, ashphalte, &c.

**Bituminous Coal**—A coal which burns with a smoky flame—such as Newcastle and similar varieties. In comparison with anthracite coal, it possesses a smaller quantity of carbon, and its heating qualities are less.

**Bivouac**—From *bis*, "double," and the German *Wache*, "a guard." An army is said to bivouac when it does not encamp at night, but rests in the open air uncovered, round large fires in the winter. This mode of resting is considered by no means unhealthy, and is a very desirable one when concentrated for immediate action, and it has this advantage over tents that it does not enable the enemy to judge the strength of his adversary.

**Black Hole**—A dark room in which prisoners or soldiers condemned for certain offences were confined. The term is now obsolete. As a term of imprisonment, the name will be familiar to all readers of Indian history, in connection with the Black Hole in Calcutta, in which so many of our countrymen were confined and died in the last century.

**Black Lead**—A name given, but erroneously so, to graphite. Black lead, which is found principally at Borradaile in Cumberland, is used largely in the manufacture of pencils.

**Black Watch**—The 42nd Regiment of the Line, and known as one of the most distinguished corps in the British army. In 'Chambers's Encyclopædia' is found the following:—"Black Watch, the appellation given to certain armed companies employed to watch the Highlands of Scotland. The term *black* arose from the dress of this species of militia being composed of tartans of dark colours. Some Highlanders had been armed by government as early as 1725, when General Wade was appointed commander-in-chief in Scotland; but it was not till about 1729 or 1730 that the companies assumed a regular form. The companies were six in number, three comprising 100 men each, commanded by a captain; and three of 70 men each, commanded by captain-lieutenants. Stationed in different parts of the Highlands, and acting independently of each other, they were styled the Independent Companies of the Black Watch." "The duties of the Black Watch were to enforce the disarming act, to overawe the disaffected, to prevent political meetings of a seditious kind, and to check depredation among the clans, or on the Lowland frontier. After being of considerable use for these local purposes, the whole of the companies were formed into the 42nd Regiment, under the command of the Earl of Crawford, in 1739." This regiment greatly distinguished itself in the late Ashantee War, as it has done in many a battle field in most parts of the world.

**Blackwood** (*Dalbergia latifolia*)—This tree grows in Southern India in the Annamallay Forest, and in other parts of India and Burmah. The wood is close-grained, strong, flexible, fibrous, durable, and of a deep purple colour. It is used in the Bombay Gun Carriage Agency for beams, cheeks, axle-beds, and poles of field carriages.

**Blakeley Gun**—A gun invented by the late Captain Blakeley, of the Royal Artillery. It is built up of wrought-iron rings or hoops, shrunk around a cast-iron core. The gun is constructed to load at the muzzle, thereby securing greater strength, and dispensing with what was thought the questionable advantages claimed for breech-loading cannon. This gun was largely introduced, at one time, into the Spanish service. The shell used in connection with this piece is of cast iron, with six buttons of zinc arranged in two rows around the cylindrical part of the ball; these enter the grooves in the bore, and give the rotatory motion to the projectile. This gun is not in the British army.

**Blank Cartridge**—A cartridge containing only powder. It is used for saluting and drill purposes with guns and small-arms.

**Blasting**—The rending of any mass of rock or masonry by means of some explosive force, such as gunpowder or gun-cotton. "When gunpowder is used, a hole is bored into the rock or masonry, the diameter of which varies from 1 to 6 inches. This hole is charged with powder and well tamped. The shortest distance from the charge to the nearest surface of the rock or masonry work, is called 'the line of least resistance,' and the charge is calculated with reference to it, and to the distance apart of the blasts. When blasts are arranged at two-line intervals, that is, are twice as far apart as the length of the line of the 'line of least resistance,' the charge varies from about ⅓ to ½ the cube of the 'line of least resistance.' But the nature of the material to be blasted has of course considerable influence on the size of the charges, and no absolute rules can be laid down on the subject. The tools used in blasting are the *jumper*, which is a long iron crow-bar, with a swell in the middle, and the *borer* and *hammer*. There is also a *tamping bar* and needle required—these are of copper. When the hole has been bored, and the charge lodged, the tamping needle is inserted in the hole, and the process of tamping commenced; this is effected by ramming home clay and the chips that have been taken out of the blast hole, by means of the tamping bar. The latter has a groove in it, in which the needle fits, so as to remain undisturbed while the tamping is going on. When this is finished, the needle is carefully extracted and the vent thus left primed with powder."—*Aide Mémoire.*

**Blindage**—A temporary bomb-proof or splinter-proof roofing, constructed of timber and the like, to give cover to magazines, batteries, hospitals, &c. There are several modes of forming a blindage. There is the *single* blindage, which consists of a row of beams leaning against a wall or parapet, and is covered with fascines, earth, or sand bags. Then there is the *double* blindage, made of two sets of beams, covered in the same manner as the single blindage, leaning against each other like an inverted V. A blindage can also be formed by demolishing the upper floor of a building, and covering the next floor with beams or any kind of protection that can be got hold of. In fact a blindage can be formed in various ways, according to the means of construction at hand.

**Blinds**—Shutters of an embrasure; they are musket-proof, and at a siege, at the discretion of the officer commanding the artillery, are made up by the engineer department from materials available on the spot. In the Crimea, coils of rope run round the chase of the gun were used in addition to the ordinary blind, to protect the gunners from the fire of riflemen when laying the gun. (*Vide* Mantlets.)

**Blind Shells**—Shells which do not explode on impact, or at the time it is intended they should. Several causes are attributed to this defect, among them the imperfect manufacture of the fuze, the insecure manner of fitting it in the shell, shrinkage of the composition, whereby the fuze is unable to act, and consequently does not ignite, and various other causes.

**Blistered Steel**—Malleable iron, subjected to the process of cementation, whereby the iron absorbs carbon. After being exposed for some days to the fire, the bars become covered with blisters, apparently from the expansion of the minute bubbles of air within the metal, hence its name. In this state it is not much used, except for welding to iron. By certain processes, it is made from this state either into shear or cast steel, and is employed in the manufacture of files, tools, and other articles comprehended under the term *hardware.*

**Block**—When two or more pulleys are placed beside each other in the same sheaf and upon the same axis, this combination of pulleys is called a *block.* Two blocks are commonly used at the same time: the one attached to a fixed point; the other to the weight, and moving with it; they are used for the purpose of changing the direction of ropes and gaining power. For military purposes blocks are usually made of wood. All pulleys are encompassed by one common rope, passing from one block to another, one of the ends of the rope being attached to one of the blocks, whilst the other is drawn by the power. By means of this system or combination of pulleys, which is called a *tackle,*

P : W :: 1 : number of parts of the cord passing over the movable block.

There are two descriptions of blocks, the *Admiralty* and *Bothway's* blocks.

**Blockade**—In a military sense, implies the surrounding of a place with different bodies of troops, which shut up the avenues on every side, and prevent all ingress or egress. Paris, in the war of 1870, is an instance of this. The design of the blockade is either to bombard the place, and so cause the besieged to surrender, or if bombardment is not resorted to, to oblige those who are shut up in the town to consume all their provisions, and by that means to compel them to surrender for want of subsistence.

**Block-house**—A small fortified barrack, loop-holed, frequently used as a keep or place of final defence in a field-work. A properly constructed block-house should have a ditch, not only to supply earth, but to keep the enemy from approaching near enough to fire the timber of the block-house. There must be always four feet of well-rammed earth on the roof to resist the effect of artillery.

**Block, Tangent**—A patch of metal in rear of the base ring of ordnance, into which the tangent scale fits or slides.

**Block Tin**—Tin which has undergone refining, either by *liquation* or *poling,* when it is run into blocks, each weighing about 3 cwt. Tin thus treated is found to form in the melting basin three strata, of which the top stratum is most pure, the bottom most impure, and the middle of average purity. The best qualities of this metal are the Banca, the Cornish, and the Spanish tin. This metal is mixed with copper to form bronze.

**Block-trail**—In artillery, that pattern of gun carriage the trail of which is formed of one beam, or two beams tabled one into the other. It is stated in Lieut.-Colonel Owen's 'Modern Artillery' that this nature of carriage was invented in 1792 by Sir W. Congreve. It has now been superseded in our lately constructed wrought-iron carriages by the bracket-trail.

**Bloomfield Gun**—An ordinary cast-iron gun, with a charge of one-third the weight of the shot. It has from 1¾ to 4 cwt. of metal to every 1 lb. of shot. The 32-pr., of 56 cwt., and 24-pr., of 50 cwt., are still in the service, as well as some other guns of this pattern. (*Vide* Appendix B.)

**Blowing Charges**—Used for different natures of common shells; they are a mixture of gunpowder and coal dust. The object of using the blowing charge is when it is not desirable or safe to burst the shell.

**Blue Lights**—Used for signals. They are to a great extent superseded by the service signal lights. The composition of blue lights consists of saltpetre, 4 parts; sublimed sulphur, 2 parts; red orpiment, 1 part.

**Blueing**—The art of imparting a blue colour to finished iron work or steel, such as gun-locks, barrels, gun sights, &c. The object in blueing articles, which is simply coating them with a thin film of oxide, is to prevent further oxidation from exposure to the atmosphere.

**Blues**—One of the three mounted regiments of household troops. This regiment was originally raised at Oxford, and was commonly called the Oxford Blues. It is now known as the regiment of Royal Horse Guards.

**Blunderbuss**—A large-bored fire-arm, capable of holding a number of musket balls or slugs. As a military weapon it was in great use in defending passages, doorways, staircases, &c. The blunderbuss is a weapon of the past, and scarcely ever seen now.

**Board of Ordnance**—Now an extinct department, but which formerly had the management of all affairs relating to the ordnance corps of the British army. It was comprised of the master-general of the ordnance, the surveyor-general, the clerk of the ordnance, and the principal storekeeper. The board was dissolved in 1854 or soon after.

**Board, Regimental**—Consists of a certain number of officers assembled by order of the commanding officer of a regiment for the purpose of investigating and reporting upon such matters as may legally be brought before it.

**Boat**—A small open vessel. It is used in military operations for crossing rivers, forming pontoons, flying bridges, &c. (*Vide* Pontoons.) When the services of a bridge of boats is dispensed with, viz. no longer required by the army, the boats should be broken up, to prevent their falling into the hands of the enemy.

**Boats, Bridge of**—A military bridge formed of boats, barges, &c. As there are a variety of shaped boats, there are many rules for their construction, taking into consideration the species of rivers to be bridged, the pressure of the water, &c. In India, bridges of boats are generally formed from the boats of the country. They are united to each other at a distance of about 6 feet by means of ropes, and anchored; they are then connected by planks, and thus afford a safe passage for troops.

**Bob**—The ball of a pendulum.

**Body**—In a military sense, is a number of troops united under one commander.

**Body of the Place**—In fortification, the space enclosed by the enceinte or line of bastions and curtains.

**Boiler**—An iron or copper vessel for containing water to which heat is applied for the generation of steam. Boilers vary in form and dimensions according to the purpose for which they are intended. The best boiler is that which, with the least cubical content, gives the greatest heating surface. There are what are termed *boilers* open vessels for boiling, mixing, and evaporating laboratory compositions.

**Boiling Point**—Is described as "that point in the temperature of water which is indicated by steam being generated. If, after this, the steam is allowed freely to escape, the temperature of the water rises no higher, however great the heat of the fire. The water is then said to boil, and the temperature at which it remains permanent is the *boiling point*. The boiling point of water is ordinarily 212°, but every liquid has a point of its own. Again, the boiling point of liquids depends on the pressure of the atmosphere. In complete vacuo, for instance, liquids boil in general at a temperature of 14[illegible] lower than in the open air. The following gives the boiling point of liquids:—

| | | | |
|---|---|---|---|
| Sulphuric ether .. | at | 100 | deg. |
| Alcohol .. .. | „ | 176 | „ |
| Water and essential oils | „ | 212 | „ |
| Water saturated with salt | „ | 224 | „ |
| Nitric acid .. .. | „ | 248 | „ |
| Phosphorus ignites | „ | 100 | „ |
| Spirits of turpentine | „ | 350 | „ |
| Sulphur volatilises | „ | 180 | „ |
| Sulphuric acid .. | „ | 640 | „ |
| Mercury .. .. | „ | 655 | „ |
| Tallow melts .. | „ | 92 | „ |
| Wax, white .. | „ | 155 | „ |
| Wax, yellow .. | „ | 149 | deg.” |

**Bollards**—Large posts driven into the ground to which hawsers or cables of any sort can be made fast. They are recommended to be provided at the tops of ramps, or in narrow passages, and in masonry works.

**Bolster**—A block of wood placed over the axle-trees of gun carriages, into which the tongue of the perch enters. Also the lower part of the cheek of a gun carriage. The iron collar in which a gun turns in the boring bench. The quoin or wooden bolster by which a mortar is raised in its bed.

**Bomb**—A shell, or hollow cast-iron globe, filled with powder; it has a fuze attached to it, which ignites the charge and explodes the shell on hitting the object. General Cotty, in his ‘Dictionary of Artillery Terms,’ states that bombs were first used at the siege of Rhodes in 1522. The first bomb shells seen in England appear to have been made in Henry VIII.’s reign, in 1543.

**Bomb-proof Buildings**—Military buildings, generally within permanent fortifications, and which are formed so as to withstand the shock of heavy shot or shell falling on them. Magazines for holding gunpowder should be placed in the most sheltered position within a fortress, and strongly constructed to resist direct and vertical fire from heavy ordnance. In the forts recently built for coast defence in this country, 17 feet of masonry has been considered necessary against direct fire, and an arch 3 feet thick, with 3 feet of concrete over the roof against vertical fire.

**Bombard**—In the early days of fire-arms, and after the introduction of gunpowder, all guns were called *bombards*, from which projectiles (stone) were propelled by gunpowder; afterwards the name was changed to cannon. Froissart mentions an extraordinary gun used at the siege of Audenarde, made by the people of Ghent; it was 50 feet long, and threw stones of a wonderful bigness; when discharged, it might be heard five leagues by day and ten by night, making so great a noise “it seemed as if all the devils in hell were abroad.”

**Bombardier**—The name given to the lowest rank of non-commissioned officers in the artillery. Bombardiers rank as corporals of cavalry and infantry. Formerly, in the French army, the duty of the bombardier was to serve mortars and howitzers only, which were bombarding arms, and hence has been derived the word bombardier. A battalion in the French service formerly consisted of four companies of bombardiers and fourteen of gunners.

**Bombardment**—Assault of a place by means of shells and other incendiary missiles. Bombardment is more frequently a naval than a military operation, though history affords us many instances of bombardments of large cities and fortresses, both in Europe and India; of the terrible effects caused by such, Sebastopol is an instance. Take also, in the war of 1870, the bombardment of Strasburg, Paris, and other fortified towns in France. Great destruction to life and property must naturally be expected in the bombardment of a fortress, falling, as it does, chiefly on the civilian portion of the inhabitants; though it is usual before bombarding a town to give women and children the opportunity of quitting the place.

**Bone Spavin**—A bony tumour in horses where the head of the splint bone joins the shank. Inflammation of the ligaments of any of the small bones of the hock proceeding to bony tumour classes as spavin.

**Boning Staff**—A T-headed staff, used in conjunction with a plummet and line for taking short levels.

**Bonnet**—In fortification, a small work, with two faces, placed before the salient or flanked angle of the ravelin, between the two tenaillons. It is intended, from its traverse-like capabilities, to be a remedy against the defects of barbettes, which, as is known to all artillerists, afford but little shelter to guns or gunners. It is necessary to add that this sort of traverse, which is built upon the parapet between the guns, limits the lateral range of the guns, and thus tends to defeat the object of a barbette.

Bonnet, in ancient armour, meant a man's head-piece.

**Boom**—An impediment drawn across the mouth of a river or harbour. It is formed generally of timber logs chained together, and anchored or otherwise secured.

**Booming**—The report of distant guns.

**Booming out**—In pontooning, the technical word of command to "shove out a pier." It is a process resorted to in making a pontoon bridge, and is performed by a pontoon being carried close to the water's edge, having a saddle and baulk attached to it; it is then pushed out or boomed out as far as the baulks permit, this process being continued until all the pontoons to form the bridge are in place.

**Boot-and-saddle**—A parade call in the cavalry and artillery, sounded half an hour before the turn-out.

**Booty**—A military term given to an enemy's property which has been captured by the troops of a conquering power. It is also called "prize property," and was originally considered as belonging to the sovereign, who conceded it to the captors as an act of grace, to be divided amongst the troops, according to a regulated scale. This booty is collected by officers of the force known as "prize agents," who convert it into money to the best advantage, and pay the proceeds over to the authorities for distribution. For their trouble the prize agents receive a certain percentage.

**Borax**—A salt of great value as a flux, and used in arsenal workshops for soldering purposes, in melting brass, and also in casting brass when the metal is in a state of fusion. Native borax or *tincal* is found in India, Thibet, Persia, and other countries. It is also manufactured in England from boracic acid with crystallised carbonate of soda.

**Bore**—The cavity or hollow of a gun or other fire-arm. The form of the bore sometimes varies, as in the Lancaster and Whitworth guns, the former being oval, and the latter hexagonal, but in most cases it is cylindrical. Technically, the bore of a gun often means simply the diameter of the cavity at the mouth of the gun, as when we speak of a gun of "8-inch bore;" and in that case its meaning is equivalent to "calibre." Howitzers and mortars have a chamber at the bottom of the bore to receive the charge; this is also included in the length of the bore. In a piece of ordnance, the length of the bore should be such as to allow of the complete combustion of the whole charge. If the bore be not of sufficient length for this purpose, a considerable portion of the charge will be blown out unconsumed. The length of the bore will, however, be limited by several practical considerations, such as the weight and length of the piece, the space it will have to occupy, and whether the gun is rifled or otherwise, &c. In all muzzle-loading rifled guns the termination of the bore and of the grooves, respectively, is marked by two lines turned round the exterior of the gun.

**Bored-up Guns**, *vide* Ream.

**Borers for Fuzes**—Instruments for boring out fuzes. There are two kinds, termed *hook* and *hand* borers; the former consists of a hook into which the fuze is placed, and a shank which contains a female screw. The bit passes through the centre of the handle and male screw, and it is secured by a small screw which presses upon the bit. The length of the bit is so regulated that, when placed in the handle, it will enter sufficiently far into the composition when screwed down to the shoulder. The hand borer is a simple instrument, somewhat like a hand gimlet, but the blade is fluted and not spiral, and supplied to each gun.

A new pattern hand gimlet borer has been introduced into the service, with rifled M.L. field guns to be used instead of the hook borer.

**Boring**, *vide* Bit.

**Boring Machine**—Boring is a branch of turning, only in the former the tool is usually made to revolve while the work is at rest. There are, however, exceptions to this. In boring S.B. cannon, which are cast solid, the gun is made to revolve, while the borer advances on a fixed axis; or in heavy ordnance, the gun may be fixed while the cutter revolves.

**Boss**—A stud or ornament raised above the leather work of a cavalryman's horse trappings. The term is also applied to a protuberance raised as an ornament on any work; to the part rising in the centre of a shield.

**Bothway's Blocks**—Two natures of these blocks have been introduced into the service, the 18- and 15-inch. They are each *single*, *double*, and *treble* blocks. These blocks in the land service have superseded the ordinary common blocks of 18 inches and upwards, but the existing store of iron gyn blocks will be used up. Bothway's blocks are made of the best English elm; the swivel, hooks, and shackles, of the best manufactured scrap iron, the straps and pins, for sheaves, also connecting pins, of the best S.C. iron, and the sheaves of phosphor-bronze.

**Bottle-necked Cartridge**—The name given to the Martini-Henry cartridge, from its bottle-necked shape. The neck or smaller diameter of the cartridge-case is formed by means of a die, so arranged as to form flutes or folds in that part of the case, and consequently reduce the diameter; the paper covering is dispensed with, a paper lining being substituted.

**Bottles, Soda-water**—Are issued in India to European troops on the march, instead of wooden canteens, for holding drinking water. The bottles are covered with leather, and have a strap attached, by which the soldier can sling the bottle over his shoulder. A water bottle has lately been introduced into the service termed the *Italian* pattern. It is of wood, cut from the solid, and is furnished with a metal stopper. This pattern bottle is to be issued to all men in the dismounted services, and will be considered the universal pattern for general service.

**Bottom, Shot**—The block of wood attached to spherical shot and shell to steady them in their passage through the bore of the gun, and to keep the fuze in the axis of the bore when being loaded. The bottom was fastened at one time by tin straps; at another with an adhesive composition. Both methods have been superseded by General Boxer's mode—viz. by attaching the bottom or sabot to the projectile by means of a copper rivet driven through the centre of the wood into a small undercut cavity in the shot; the shape of the hole and the malleability of the metal causing the sabot to cleave most closely to the shot or shell.

**Bouche**, or **Bush**—A cylindrical piece of hardened copper, through which the vent of a gun is drilled. It is inserted into the vent field in the form of a screw, after the piece has been turned. There are two kinds of copper bushes, the *through vent* and the *cone vent*. If necessary, bushes can be removed or renewed.

**Bouching**, *vide* Bushing.

**Bounty**—A sum of money, formerly given by government to men enlisting into the army. This donation has been withdrawn, and only a free kit is given to the recruit. Recruits entering the militia are entitled to bounty (annual) under the regulations laid down for that service.

Colonel Burn, in his 'Naval and Military Dictionary,' states that, in the artillery, bounty was formerly given for each day that a gun or mortar remained in battery during a siege.

**Bourgenot**, or **Burgonet**—One amongst the many kinds of ancient helmets worn in the fifteenth century, and so late as the reign of James I.

**Bow**—One of the earliest arms or weapons we are acquainted with; of equal, if not greater, antiquity than the sling. The first account we find of it is in the Book of Genesis (xxi. 20), when the lawgiver, speaking of Ishmael, says, "and God was with the lad; and he grew, and dwelt in the wilderness, and became an archer."

**Bow, Cross**—An ancient weapon of offence, in use in the eleventh century. Philip II., surnamed the Conqueror, introduced cross-bows into France. In his reign Richard I. of England was killed by an arrow shot from a cross-bow at the siege of Chaluz.

**Bowline**—A very useful knot, known as the single, running, and double bowline knot. The single bowline serves to throw over a post to haul on, also to sling a barrel; the running bowline for securing paulins on ammunition wagons; and the double bowline for slinging a cask.

**Bowsing Rope**—A rope used in the artillery service for moving a weight by simply hauling upon it.

**Box, Nave**—The gun-metal pipe or box which is introduced into the naves of all wheels, and in which the axle arm works.

**Box, Sextant**—A surveying instrument, which is as portable as the prismatic compass, forming, when shut up, a box about 3 inches in diameter, and 1½ inch deep. It measures the actual angle between any two objects to a single minute.

**Boxes, Gun Ammunition**—Wooden boxes of certain shapes and dimensions. There are an infinite variety in the service, every nature of gun and carriage, siege or field, having, it may be said, its own pattern box. As the name implies, these boxes are for the storage and transport of ammunition, in time of peace or war.

**Boxes, Small-arm Ammunition**—Wooden boxes, generally made of teak, for holding all natures of ball cartridge. These boxes are ordered for the future to be lined with tin.

**Box-wood** (*Buxus emarginatus*)—A tree which grows in the south of Europe, also in the Himalaya Mountains, in the Kooloo district, and Kumaon. It is a valuable wood, of a yellowish colour, close-grained, very hard, and heavy. Amongst its other uses is that of plugs for elongated bullets.

**Boyaux** (French, entrails)—Zigzag of trenches of approach.

**Brackets**—In artillery, the cheeks or sides of ordnance carriages. Carriages termed "bracket-trail," in contradistinction to the "block-trail" pattern, have been introduced into the service; all the new field and some of the siege carriages have been made of this pattern.

**Braid**—A kind of tape, of broad proportions, which is used for hooping cartridges of 40 lbs. and upwards.

**Brake, Allen's**—A contrivance for checking violent recoil. It is thus described by Captain Kemmis, R.A.:—"It consists of a wooden wedge, shod with iron, attached to the bracket immediately in rear of the truck by jointed bars of iron, the upper of which are bolted to the bracket, while from the joint another bar passes horizontally through the axle-tree arm forming the linch-pin. The wedge rests upon the ground in rear of the truck, following it as the carriage is run up, but on recoil the truck overtakes and rides upon the wedge. A rope lanyard is attached to the wedge, and an iron cleat upon the side of the carriage, so that, if it is wished not to use the brake, the wedge can be secured so as not to come into action on recoil."

**Brass**—An alloy of copper and zinc. This name, in connection with guns, is commonly given to bronze ordnance, but erroneously so, bronze ordnance being made of copper and tin. Brass, as now alluded to, is largely used for household furnishings, certain parts of machinery, and other ornamental and useful articles.

**Brassards** — In 'Chambers's Encyclopædia' they are explained as "the name of the pieces which, in plate armour, protected the upper part of the arms, and united the shoulder and elbow pieces. Brachiale was the ancient name for brassards. When the front of the arm only was shielded, the pieces were called *demi-brassards.*"

Brassards or armlets, made of cloth, and worn on the arm, are now used as a badge of recognition by the *personnel* and all members of the military and international ambulances in time of war. The colour of the cloth is white, with a red cross woven on it, which is the emblem of the Society for the Help of the Sick and Wounded. The armlets are issued on the commencement of hostilities by the central committee of that society, and duly stamped and numbered, so as to prevent fraud.

**Breach**—An opening effected by artillery or by mining in the walls and defences of a fortified place. A breach is considered practicable when a sufficient quantity of material has fallen to render the ascent easy to the assailants.

**Breaching Batteries** — Batteries of heavy guns made use of in the operations of a siege, to form a breach or opening in the front to be attacked, so as to enable the besiegers to gain admittance into the place or fortress. With this view guns are placed on the crest of the glacis and in further advanced positions, according to the progress made by the besiegers, to breach first such works as ravelins, before effecting a breach in the bastion. Probably in future sieges, on account of the introduction of rifled arms, there will be great changes in the attack of fortresses as regards the position and the distance of the breaching batteries. Curved fire, which admits of the besiegers breaching walls without seeing them, as occurred at the siege of Strasburg during the Franco-Prussian campaign, will doubtless alter the position of breaching batteries, and prevent their being exposed. The distances at which the opening of the trenches will take place, and the thickness of the parapets of the various works of the besiegers, will also probably be altered. For information as to the mode heretofore of carrying on a siege and the changes that are likely to take place, consequent on the introduction of rifled artillery and small-arms, *vide* 'Instruction in Fortification, &c., at the Royal Military Academy, Woolwich.'

In forming a breach regard should be had to the velocity with which each shot will strike the work to be breached; it should not exceed 1000 feet per second, as low velocity causes greater vibration to the mass intended to be brought down. The best method of forming a breach is first to cut the masonry or revetment in a horizontal direction, and then vertically, at such distances as the strength of the masonry, &c., may require; the height of the horizontal cutting being about one-third the total height of the escarp from the bottom, the length generally from 20 to 30 yards.

Firing breaching guns in salvos is found to be very effective either against masonry or even earth-works. The simultaneous concussion of a number of balls has a most destructive effect in bringing down the mass to be breached.

**Breaking-down**—In the manufacture of gunpowder, is the process the mill-charges undergo on leaving the incorporating mills, and again after the press-cake leaves the press. The machine to effect this operation consists of two or more pairs of toothed gun-metal rollers, a hopper to contain the mill-cake, and an endless band to convey the cake to the hopper. Breaking-down, after the powder leaves the incorporating mills, is necessary in order that the meal may sit well in the press trays, previous to being subjected to hydraulic pressure. The necessity, after it has been pressed, of breaking it down, is to admit of its passing easily through the granulating rollers.

**Breaking Ground**—In military operations, the first excavation of the earth to form entrenchments, as at the commencement of a siege. It is applied also to the striking of tents, and quitting the ground on which troops have been encamped.

**Breastplate**—As its name implies, is a plate of metal for covering the breast. It was commonly worn in ancient armour, either made of iron, steel, or other metal. It covered the back of the soldier as well as the front. (*Vide* Cuirass.)

**Breast-work**—A hastily constructed parapet, thrown up as high as the breasts of the troops defending it. (*Vide* Intrenchment.)

**Breech of a Gun**—The mass of solid metal coiled round the end of the breech of a rifled gun, or cast at the end of a smooth-bored gun. The excess of metal at the breech is to enable the gun to withstand the shock occasioned by the explosion of the gunpowder. Small-arms have also an increase of metal at the breech.

**Breech-loading Guns**—As the name implies, are guns which are loaded at the breech instead of at the muzzle. They were introduced into the service some years ago by Sir W. Armstrong, but have been superseded, to a great extent, by the present muzzle-loading rifled gun, light and heavy. The principal continental powers have however adopted the breech-loading system. Whether this system possesses all the advantages claimed for it remains yet to be proved; actual warfare and trial will enable us to judge as to its safety and the enduring qualities of the guns. The great disadvantage of the system appears to be the want of a good time-fuze; this will doubtless be remedied in the future.

During the Franco-Prussian war the field artillery of the Prussians were chiefly breech-loaders. It is said that many of these guns were disabled; but the manufacture has since greatly improved, and the system of "building up" the gun with steel hoops instead of forming the gun out of a block of steel will alone doubtless add to the life of the gun. If the metal can be depended on, and a secure breech-closer be made, the breech-loader may again be introduced into the British service, though the present experience of our M.L.R. guns is against its reintroduction.

Sir J. Whitworth has managed by hydraulic pressure so to condense his steel that no air bubbles or flaws can possibly remain in the metal. Here then is a metal which will make a good gun, and the P. powder now in use for large charges would admit of the gun being loaded at the breech with great safety.

Breech-loading is no new invention; many of the ancient cannons appear to have been loaded by removing a breech-part or chamber, inserting the charge at the breech, replacing the chamber, and securing it by wedging it behind. Breech-loading has been universally applied to small-arms, and with great success, as the Snider, Martini-Henry, and other rifles have shown.

**Breeching**—Harness adapted to the wheel horses of gun carriages, *near* and *off*, for the purpose of facilitating the stopping of a gun in motion. Breechings, near and off, are strengthened with a *lay* of leather.

**Brevet** (French *brevet*, commission, appointment) — A rank in the army higher than that for which regimental pay is received, and is conferred upon individual officers for special and long services. Brevet rank being rank in the army, an officer takes his position with the officers of the army according to the date of his commission.

**Bridges, Military**—Temporary constructions to facilitate the passage of rivers by troops. There are several descriptions, viz. bridges of boats, pontoon bridges, bridges of casks, trestle bridges, raft bridges, spar and flying bridges, a description of which will be given under their respective heads. The three first natures of bridges are most commonly used. Trestle bridges are chiefly applicable to rivers in hilly countries, where the three first-named bridges cannot be used. The raft is the last expedient that should be adopted by an army in motion, as it has the lowest degree of buoyancy and general manageability. Its merits are that, at the expense of time, it can be constructed with less experienced workmen; it saves carriage, as it can be made of any materials on or near the spot. Spar bridges are used for crossing broken arches, rivers with steep banks, &c.; flying bridges, when wishing to pass a river in the face of an enemy, either by stratagem or force, as they require but little preparation. A pontoon and cask bridge is similarly constructed.

**Bridge Head,** *vide* Tête-de-pont.

**Brigade**—A body of troops, the unit of a division. Generally it consists of either of the three arms, or of the three arms combined, commanded by a brigadier-general or brigadier. Two or more battalions of infantry, with a regiment of cavalry and a battery of artillery, under the command of one officer, commonly constitute a brigade. The term brigade is given also to the Brigade of Guards, which consists of the three regiments of Foot Guards; to the Household Cavalry Brigade, which is composed of the two regiments of Life Guards, and the Royal Horse Guards.

This word appears to have had some connection with the word "brigands," light armed soldiers in early Biblical days; probably because they were broken off or detached from the main body, as a brigade may be at the present day from a division. The corslets of these brigands were styled "brigandines." Soldiers of this kind often marauded on their own account; hence the sense which brigand has with us now.

**Brigade Depot**—The head-quarters of a sub-district of the army. Under the new localisation of the British army, the military districts of Great Britain and Ireland are divided into 12 districts, which are sub-divided into 70* infantry and 12 artillery sub-districts, and 2 cavalry districts. The infantry sub-districts, as a rule, correspond with the several counties into which the United Kingdom is divided. In connection therewith the following arrangements have been made (*vide* Auxiliary and Reserve Forces Circular for 1873):—To each infantry sub-district are assigned 2 battalions of infantry of the line, one of which is ordinarily at home, and the other abroad. The battalions are linked together for the purposes of enlistment and service (*see* G. O. 18 of 1873). In each infantry sub-district is located a brigade depot under the command of a lieutenant-colonel, composed of 2 companies from each of the line battalions assigned to the sub-district. The line battalions, militia battalions, the brigade depot, the rifle volunteer corps, and the infantry of the army reserve, constitute the infantry sub-district brigade, and the whole, with the exception of the line battalion, are under the command of the officer commanding the brigade depot.

A lieutenant-colonel is appointed to each artillery sub-district, and he is invested with the command of the auxiliary and reserve forces of artillery of the sub-district.

The cavalry of the auxiliary forces is divided, as before stated, into two districts. A lieutenant-colonel is appointed to each district, who is invested with the command of the yeomanry regiments and of the corps of light horse and mounted rifle volunteers within his district.

The regiments of guards, the 60th Rifles, and the Rifle Brigade, are outside the sub-district organisation—i.e. they have no special connection with any territorial sub-district. The depot of the Guards continues as at present constituted. The 60th Rifle Brigade have one consolidated depot at Winchester.

The above explains the organisation, as laid down by the warrant, for the maintenance of the sub-districts. It is further directed that in exercising authority over the auxiliary and reserve forces, officers appointed to command must remember that these forces have been enrolled under conditions very different from those of the regular army. They must therefore take great care not to exceed the powers conferred upon them by law, and, in exercising the powers which they do possess, must endeavour to carry with them as far as possible the opinions of the commanding officers of the auxiliary forces. In all cases of doubt, the warrant says, they will do well to refer to the Inspector-General of the Auxiliary Forces.

It is ordered in the Queen's Regulations that "a mess shall be established at the head-quarters of each brigade depot, which will be credited with one-fifth of the contributions of the company officers of each line battalion belonging thereto, assessed agreeably to paragraphs 32 and 33, as well as with the annual subscriptions of the officers of two companies thereof. The lieutenant-colonel, the major and staff will pay subscriptions only. The two companies of the line-battalions will bring, on joining a brigade depot, a sum of 50*l.*, for the purchase of such articles of equipment as may be necessary, or in lieu thereof a sufficient amount of mess property."

The plan adopted in forming the brigade depots was to associate with the militia of each county certain line battalions, selecting as far as possible such regiments as had any connection with the county, besides such volunteers and army reserves as may be in each brigade district. Each brigade has its depot stationed permantly in the district it belongs to; the line battalions are moved as the service may require, one being at home and the other abroad, the militia are embodied periodically as heretofore; but all recruits for either branch of the service are intended to pass through the same hands, and to receive their training together. The cavalry, artillery, engineers, guards, and rifles are exceptions to these arrangements, and remain not localised. (*Vide* Appendix E.)

---

* There are 4 brigade depots at Winchester, forming an united rifle depot, which belong to no particular sub-district, and are outside the local organisation, only half of which are now formed: but they make up with the 66 districts the 70 alluded to.

**Brigade, Flying,** *vide* Flying Brigade.

**Brigade Major**—An officer appointed to aid the brigadier in carrying out the duties of his brigade. Each brigade of the army has a brigade major attached to it, combining the duties of all military departments except the control. He is the channel of orders for the brigade, keeps a register of duties, inspects all guards and posts and pickets, and when in the field is responsible for their being withdrawn when the brigade marches. The office is seldom held by any one under the rank of captain.

**Brigadier**—A military officer whose rank is next above a colonel. He exercises the command of a brigade of troops, with the rank, now-a-days, of a brigadier-general.

**British Army**—The army of the British Empire. This army is raised by voluntary enlistment, a system peculiar to England; the continental armies being raised by compulsory service. In the British army, the time a soldier engages to serve is twelve years; six years, and not less than three years of which must be passed with the colours, the rest of his service in the reserve. This is called *short service*.

By a bill passed in 1872, the 109 regiments of the British army, with the Rifle Brigade, are distributed among the 12 military districts of England, which districts are sub-divided into 70 sub-districts, each sub-district having 2 battalions allotted to it. This forms the basis of the present military organisation of this country. Each sub-district has a depot brigade, to which, besides the 2 battalions, is attached the militia and volunteers of the sub-district.

The artillery and cavalry have special organisations, there being 12 sub-districts for the former, and 2 districts for the latter.

The British infantry is composed of 3 regiments of foot guards, viz. Grenadier Guards (3 battalions), Coldstream Guards (2 battalions), Scots Fusilier Guards (2 battalions); total 7 battalions of 16 companies.

The 109 regiments of the line include 12 Highland regiments, and the first twenty-five have 2 battalions each. The 60th Rifles and the Rifle Brigade have each 4 battalions; these regiments, as well as those which have more than one battalion, have their own commanding officer, and promotion goes on in independent cadres.

Each battalion of a regiment has 8 companies, of the strength, nominally, of 604 men in this country and 918 in India, and varies in the other colonies.

The cavalry is composed of 31 regiments, viz. 3 regiments of life guards, 7 regiments of dragoon guards (heavies), (the 6th regiment is called Carabiniers), and 21 regiments of the line, of which 3 are heavy dragoons, 5 lancers, and 13 hussars. Each regiment has 8 troops of 535 men in England, and 7 troops of 544 (depot included) in India.

The artillery is composed of 5 brigades of horse artillery, of 5 batteries of 6 guns each. The complement of men is 1284 to each brigade and 904 horses; this is the number laid down for home service. The numbers differ both in men and horses for India. Besides the above horse brigades, there are 25 foot brigades, 10 of which are field brigades, and the batteries horsed. To each field brigade there are 7 batteries attached, of 6 guns each, and the number of men and horses to each brigade is respectively 1610 and 850. The remaining brigades are composed of garrison artillery, of 7 batteries each. The strength of each brigade varies from 1150 to 730 men. There is besides a brigade of coast artillery and a depot brigade.

The engineers have 40 companies for home and foreign service, and 4 pontoon troops.

Besides the regular troops as shown above, England has a reserve in her auxiliary forces, viz. the militia, volunteers, and yeomanry, the strength of which, including the line, taken from the latest parliamentary returns, is as follows:—Regular forces, 192,000; militia, 118,000 (of whom only 103,000 will be enrolled); volunteers, 161,150; enrolled pensioners, 21,980; yeomanry, 12,500; Class A, army reserve, 7928. In all, 513,558. Besides the combatant force above mentioned, there is a large staff of the military and civil departments. The latter includes the control and medical branches. The militia is organised for the home defence of the United Kingdom, though, during the Crimean War, militia regiments garrisoned Malta. The service of this force is compulsory for every Englishman, but by a law passed yearly he is dispensed of this service, as long as the number of men necessary to fill up the ranks of that force present themselves voluntarily. The engagement is contracted for five years. The volunteers form an invaluable force for the protection of the country, and in the day of need will be found all that is expected of them. For the constitution of this force, *vide* Volunteers. The yeomanry of Great Britain is a body of cavalry volunteers, and their origin and organisation will be found under the head Yeomanry.

Previous to November 1871, appointments in the infantry and cavalry were made under the purchase system. Purchase was abolished by the Warrant dated 20th July, 1871, and candidates for commissions in the line since then have to pass competitive examinations. (*Vide* Appendix A.) Promotion in the army by purchase was abolished by the same warrant, and the system of promotion since will be found also in the Appendix.

In the artillery and engineers, cadets, after undergoing an examination, previous to entering the Academy at Woolwich, have to remain there for three years, when, if found competent, they are finally classed, and receive commissions in the engineers or artillery, according to their standing on the list. Those selected for the engineers go through a special course at Chatham in engineering and other studies having reference to their branch of the service. Artillery officers, if so inclined, can improve themselves in the higher branches of their service, by attending the advanced class at Woolwich. Regimental promotion is governed in both services by seniority. (*Vide* Appendix A.)

A slight sketch is herewith given of the rise and subsequent formation of the British army, a subject which will be interesting to every soldier, though it is necessarily given in a concise form.

The feudal relation between lord and vassal led originally to the existence of armed and dependent bands. But this soldiery was virtually the soldiery of the barony. The armed force in England at that period was no strictly organised force. The armed retainers of the barons were subservient to the will of the sovereign, but only within the narrow term of service in the field. The wars of Edward III. and of Henry V. were effected through the royal purse and the co-operation of the royal vassals. The Wars of the Roses were the wars of rival families. A royal army, such as we now possess, an army alien to any feeling but that of loyalty, was a thing unknown in the middle ages of English history. The king issued a commission to the county. By the sheriff a county force was raised. But that the feudal force of the great nobles should be at the service of the king, in time of danger, depended wholly on the good faith of those nobles. In the reign of Henry VII. the power of assembling men for the defence of the counties was placed in the hands of the lord lieutenants and deputy lieutenants of counties. But the want of an organised force, at the hands of the monarch, may be seen from the ease with which a mob of rioters from the northern shires or the west country marched to the gates of London. In the reign of Charles I. came the question whether the sovereign could, or could not, maintain a military force without the permission of parliament. The question was all the more irately discussed when Charles billeted his soldiers on the people.

During the reign of Charles II. appear the germs of our present military system. A body-guard, or household brigade of 5000 men, was sanctioned by the parliament. But even this insignificant force was viewed with apprehension at the time, as a step towards the position assumed by Louis XIV. It appears, however, that after the 13th year of Charles's reign he obtained a statute declaring that the sole and supreme power, government, command, and disposition of the militia, and of all forces by sea and by land, and of all forts and places of strength, is the undoubted right of his majesty; and both or either of the houses of parliament cannot nor ought to pretend to the same. But the profuseness of Charles and the folly of James prevented them employing this instrument.

In the reign of William III., the fear of an army, at the disposal of one who might prove to be filled with arbitrary notions of government, was destroyed. The Declaration of Rights settled, in positive terms, that the raising and keeping of a standing army in time of peace, without the consent of parliament, is contrary to law. The first Mutiny Act was passed in 1689. It was to last for six months only; but it has been renewed annually ever since, except in three particular years. It constitutes the warrant upon which the whole military system of England is exercised by the sovereign with the consent of parliament.

From what has been stated, it will be seen that the sovereign, without the sanction of parliament, has no power to raise a military force, and it has been the custom, for the last 180 or 190 years, for the minister of the crown to ask annually of parliament the permission to raise a military force, and to ask for money to pay the same.

The head of the army is the Sovereign, assisted by the Secretary of State for War, in some matters, and by the Commander-in-Chief in others.

**Broad Arrow**—The ancient mark of crown property. It was originally used only on Admiralty stores. The object of the mark was generally to prevent embezzlement. Any dealer having in his possession stores with the government arrow on it is liable to a fine and confiscation of the property. It is applied generally to ordnance, as well as to other articles which belong to the War Department. The mark is for iron and wood what the coloured thread is for sailcloth.

**Broadsword**—A sword with a broad blade. It is only used now by some Highland regiments. This national sword is better known under the name of claymore.

**Bronze**—Bronze is an alloy of copper and tin in the proportion of 88 to 92 per cent. of the former, and of 8 to 12 of the latter; but the amount of tin in bronze varies in different countries. Bronze is used in casting guns, which are commonly, but erroneously, called "brass cannon." This alloy, of which all field guns in the past were made, is now no longer used, as the guns on being rifled were found to score and erode more than they had done in their smooth-bore state, and to be greatly weakened from the effect of the rifling, which laid bare hidden weaknesses in the metal from the want of homogeneity. Bronze has been known from the earliest ages, under the name of brass, but which was really bronze, as the most ancient coins attest. So well known was this alloy that it led to a period in antiquarian history styled "the Age of Bronze," in which arms of this alloy were universally made.

**Bronzing**—The mode adopted for the protection from the influence of the atmosphere of the exposed gun-metal portions of all the tangents and drop sights of a gun. The preparation of the fluid used in the above process will be seen in the 'Text-book of the Construction and Manufacture of Rifled Ordnance.'

**Browning Barrels**—Is the process pursued in coating the barrels of muskets to prevent them from rusting. The following is one of the receipts found to be successful in the operation of browning barrels, especially in India, and is known as the Pimlico receipt. The same materials, but in different proportions, will answer for the browning of all wrought-iron guns.

*Pimlico Receipt.*

| | | | | | |
|---|---|---|---|---|---|
| Acid, Nitric, by weight, | | lbs. | 0 | 1 | 14 |
| Spirits of nitre | „ | „ | 0 | 4 | 8 |
| „ „ wine | „ | „ | 0 | 3 | 0 |
| Tincture of steel | „ | „ | 0 | 5 | 4 |
| Vitriol, blue | „ | „ | 0 | 0 | 12 |
| Rain water | „ | „ | 1 | 2 | 0 |

The foregoing is sufficient for 100 rifle barrels.

**Brunt**—The troops which sustain the principal shock of the enemy in action are said to bear the "brunt of the battle."

**Brushwood**—Rough, low, close thickets; underwood, branches of trees cut off. The use it is put to is in making gabions, fascines, and pickets. Brushwood for the above purposes should not exceed 1¾ to 2 inches in diameter at the butt or thick end. Brushwood is cut and tied up in bundles, weighing from 40 to 50 lbs. each.

**Buckler**—Is a military term of very

ancient date. It means a small shield with a knob or boss in the middle of it, called in French *boucle*.

**Buckshot,** *vide* Cartridge Buckshot.

**Buff**—The leather of which soldiers' belts are made. The following is the process pursued in its preparation:—

Buff or "losh leather" is manufactured chiefly from the hide of the buffalo. The process of softening, removing the hair, cleansing, &c., is precisely the same as that for common leather (*vide* Leather), until the "pelt" is ready for tanning, when it has to be prepared for a process of oiling. This is done by carefully removing or forcing off the upper grain of the hide, which renders both sides of it as nearly alike as possible. The hides are then subjected to the process of "branning," that is, being steeped in fermented bran from four to twelve hours, according to the atmosphere. They are then wrung out or scraped over, and subjected to the pulling mill or stocks for two or three hours; afterwards they are spread out and oiled. Cod oil is the best for this purpose. The oiling is repeated during the first three or four days until each hide has absorbed ¾ of a gallon. For the following three weeks, the hides are subjected to alternate soaking and drying, in which great care and attention is required. They are then exposed to a heating process, in hot-houses prepared expressly for the purpose, for two or three days, the heat not exceeding 130° Fahrenheit. Having arrived at this stage, the oil has now to be extracted, which is effected by a solution of potassa, in mills constructed for this purpose. The buff is next carefully cleaned from all alkaline matter by frequent washings, and each hide hung up separately to dry. The facing or surface is completed by rubbing both sides with pumice-stone, and the buff is then in a fit state to be cut up into accoutrements.

The above description is the mode pursued in India. The process is somewhat similar in this country, the hides used being those of the ox and cow, a large quantity of which are imported from South America.

**Buffalo**—An animal of the ox tribe. It is a native of the East Indies. This animal is seldom used for military purposes. The natives of India, however, use the buffalo occasionally both as a beast of burden and for draught purposes. When dead, the hide is used for leather.

**Buffer, Hydraulic**—A contrivance, as applied in the service of artillery, for checking the recoil of heavy guns. "The hydraulic buffer consists of a wrought-iron cylinder, closed at one end, the other end fitted with a cap and stuffing-box, through which a piston-rod passes. The piston fits well into the cylinder, and is perforated with four small holes, the size of which varies with the size of the gun. The cylinder is filled with Rangoon oil or with water, enough air space being left to act as an elastic buffer, which takes off the violence of the first impact of the piston on the oil. The cylinder is firmly attached to the platform on which the carriage recoils, and the end of the piston-rod to the carriage itself; so that on the discharge of the gun, the carriage drives the piston through the oil or water with great velocity, gradually bringing the gun and carriage to rest in the required distance."

The orders laid down for the preservation of hydraulic buffers are as follows: "In all cases where guns are mounted on carriages and platforms fitted for hydraulic buffers, the buffer will invariably be kept on the platform filled with the proper quantity of oil; and when not required for immediate use, the piston will be disconnected from the carriage and pressed home into the cylinder."

**Bulletin**—Any official account which is given of public transactions.

**Bullets**—Leaden balls, either *spherical* or *elongated*, fired from small-arms. They are also used in the preparation of canister shot. The service bullet used with the Snider rifle is ·55 in. in diameter: weight, 466 to 468 grains with plug. The Snider bullet is elongated, and receives a small wooden or clay plug at its base, which, on the piece being fired, expands the lead and causes the bullet to fit the base tightly and to fill the grooves of the rifle. The Martini-Henry bullet is ·45 in. in diameter, and weighs 410 grains.

**Bullock**—This animal is used in India for drawing heavy guns, ammunition, stores, &c. All carts are drawn by bullocks in India, whether in the ordnance or commissariat department. The bullock for military purposes is obtained from certain districts in the country, and is much larger than the usual species of this animal. The pace of the bullock is slow, rarely exceeding 2 or 2½ miles an hour, but he has much endurance, and in draught can draw 5 cwt. the usual length of march, without being distressed.

**Bull's-eye**—A black rectangular figure on a white ground which is painted on targets, varying in size according to the distance at which the target is placed, and according to the class of marksmen firing at it. Outside the bull's-eye is a white space bounded by rectangular black lines. The space within these lines and between them and the bull's-eye is called the centre. Outside these lines is the remainder of the target.

**Buntin**, or **Bunting**—A thin woollen cloth, of which naval and military flags are made.

**Burette**—A graduated glass instrument used in the chemical laboratory, and elsewhere, for the purpose of dividing a given portion of any liquid into 100 or 1000 equal parts.

In the use of the burette much loss of time and risk of error are avoided; and in the analysis of large quantities of saltpetre, such as is carried on in gunpowder factories, it is invaluable.

**Burns**—As scalds and burns are not unfrequent in the laboratory, the following will be found a useful liniment:—

| | |
|---|---|
| Sweet oil .. .. | 8 parts, |
| Hartshorn .. .. | 1 part, |

or equal parts of linseed oil and lime water.

**Burr**—Any roughness or unevenness observed in the barrels of guns after manufacture, or on balls which have been cast, or on the edge of tools when ground, or in wood-work when turned, caused by the inequality in the fibres of the material.

**Bursting Charge**—A charge of powder placed in shells of all natures, in order that they may burst at the distance required. The charge is ignited by means of a fuze, except in the Palliser shell, which ignites itself, against iron-clad ships. The ignition of the powder in these shells is supposed to be caused by the violent concussion of the shell on striking. There is a variety of patterns of bursters in the service, made of paper and serge. For the most part shells are filled by capacity, not measure, but there are certain exceptions.

**Busby**—The head-dress worn by the artillery and hussars in the British army. It consists of a fur hat, with a bag hanging from the top over the right shoulder. The bag, which is made of the same colour as the facings of the regiment, appears to be of Hungarian origin, and intended to ward off a sword cut. In India the artillery, whose head-dress in Europe is a busby, do not wear it, but are provided with wicker helmets covered with white cloth.

The head-dress worn by the fusiliers is called a "busby," and is made of black racoon skin for the officers and of seal-skin for the non-commissioned officers and men.

**Bushing**, or **Bouching**—The operation of fitting one piece of metal into another, which is generally bored for that purpose, in order to receive either a fresh aperture, such as the vent of a gun, or, as in the case of a shell, to receive a fuze which does not fit the original fuze-hole.

**Bushing Tents**—This is resorted to when the soil will not hold well, or in stormy, blowing weather. It is only necessary under these circumstances to bush the main outer ropes of the tent, which is effected by burying, to a sufficient depth in the ground, a strong bush at each angle of the tent, to which ropes are attached.

**Buttresses**, or **Counterforts**—In fortification, solid constructions of masonry, raised at short and equal intervals on the interior side of the revetment of the ditch, to strengthen and support it.

**Butts**—Mounds of earth raised behind the targets on military practice grounds, for the purpose of stopping the onward course of shot, bullets, &c.

**Byl**—One of the early Norman arms resembling a war-hatchet.

## C.

**Cable,** *vide* Rope.

**Cacolets**—Folding-chairs made to be slung on a pack-saddle, one on each side of a mule. They are used for carrying the sick or wounded in the day of battle. They weigh 56 lbs. the pair. The pack weighs the same. Add the weight of two men, say, 150 lbs. each, total weight to be carried, 400 lbs.—rather an excessive weight for any but a first-class mule. This nature of chair is very tiring for the sick man to be carried in, and it is difficult to place men in them.

**Cadastral**—This term is derived from the French word *cadastre*, a register of lands, or from *cadrer*, to square, and signifies a survey on a large scale, such as has been adopted of late years on the continent of Europe, and is now used in England in the ordnance maps. The measurement corresponds so nearly to 25 inches to the mile that it is usually spoken of as the 25-inch scale. It has the further advantage of bearing, within a very small fraction, the proportion of one inch to an acre. A cadastral as opposed to a topographical map may be defined to be one on which the subjects represented agree, as to their relative positions and dimensions, with the objects on the face of the country; while a topographical map, drawn on a small scale, exaggerates, for the sake of distinctness, the dimensions of houses, and the breadth of roads and streams, and is, owing to its smaller size, necessarily less correct than a cadastral plan.

**Cadet** (French *cadet*, younger, junior in service)—This term is given to students who are being educated at a military college for the army. Cadets for the engineers and artillery are brought up at the Royal Military Academy, Woolwich, and on passing their final examination receive commissions in one of the above corps according to their qualifications. Formerly cadets for the line were educated at Sandhurst, and on being qualified received their commissions. But this has been altered, and candidates for the infantry and cavalry branch of the service have to pass an examination under the Civil Service Commissioners, when, if found qualified, they receive their commission with the rank of sub-lieutenant, and are sent to Sandhurst to learn their drill and other military duties. While at Sandhurst, they are placed on an unattached list of sub-lieutenants, and are not posted to regiments until they have completed their instruction. Sub-lieutenants, however, intended for regiments in India, proceed at once to join them, and are instructed under the eye of the commanding officer, and have to pass a similar examination under the garrison instructor of the district to that they would have had to undergo at Sandhurst. The garrison class lasts about eight months.

**Cadre** (French, a frame)—The skeleton or staff of a regiment; list of officers.

**Caffin's Machine**—A machine formerly used for filling cannon cartridges. This machine, since the introduction of heavy charges for rifled guns, requiring great nicety in weight, has become obsolete in the service.

**Caisson** (French *caisse*, box)—Formerly the name given to a tumbril or ammunition wagon.

**Cake, Mill**—Gunpowder after it leaves the incorporating mill; its thickness in this form varies from ¼ to ½ inch. It is of a blackish grey colour, and, when broken, should exhibit the same uniform appearance without presenting any sparkling or yellow specks; should it however do so, it is a sign that the ingredients have not been properly mixed or incorporated. After the mill-cake leaves the incorporating mills, samples of it are tested "for strength" in a small eprouvette.

**Cake, Press**—Gunpowder after it has been subjected to hydraulic pressure. The different natures of powder used in the service receive a pressure of so many tons on the square foot, with reference to the density required. Pebble powder receives a pressure which gives it a density in excess of the usual powders. The amount of pressure varies with the season of the year, less pressure being required in summer than in winter.

**Caked Gunpowder**—Gunpowder which has become lumpy from having imbibed moisture. In this state little permanent good can be done to it by reeling and re-drying it, unless it is used at once, as after a time it absorbs more moisture than it did before; powder, therefore, in this state should not be re-stoved. This does not apply to pebble powder, the grains of which are too large to cake.

**Calibre**—The diameter of the bore of a gun is its calibre. Guns are denominated according to the weight of their shot; siege howitzers, mortars, and other guns in terms of their calibres, expressed in inches and decimals; thus a 24-pr. gun, from its shot weighing 24 lbs., is termed a 24-pr.; and an 8-inch howitzer, or 8-inch mortar, from the diameter of its bore being of that size, is denominated an 8-inch howitzer or mortar. The latter appears to be the more exact method of classing ordnance. The calibres of all heavy rifled guns, from the 12½-inch to the 7-inch, the projectiles of which, like all fired from rifled guns, are oblong, are expressed in inches, but the smaller natures of rifled ordnance in pounds. For the calibre of guns, *vide* Appendix.

**Call**—In a military sense, applied to the assembling of troops by beat of drum, bugle, or trumpet. Thus:—A call to arms, roll call, tattoo call, are all well-known calls.

**Callipers**—Gun implements of different natures. They are used for measuring the bores of ordnance, diameter of shot and shell, and in ascertaining the thickness of the metal of spherical projectiles, &c.

**Caliver**—A kind of musket, so called because the bore was of a fixed size, in order that the common stock of bullets might fit every piece in a regiment; it was of greater calibre than the arquebus; was lighter than the musket; was fired without a rest, and could be discharged more quickly than a musket; the shot from the latter, however, did the greatest damage.

**Cam**—A contrivance in machinery for converting a rotatory into a reciprocating motion. On the breech cylinder of the Armstrong gun a ring is fitted to which cams are attached. This ring fits with its interior octagonal figure with the exterior octagonal figure of the cylinder. The weighted lever, with a piece projecting, works on the cylinder also; and on the lever being worked round, the piece projecting catches the cams, and this screws home the breech screw.

**Camail**—A neck-guard of chain, added to the bascinet. The word is either corrupted from *cap-mail* or owes its origin to the camail resembling the lower part of the capuchon, commonly worn by all classes, but which among the higher ranks was made of camel's hair, and therefore termed *camelin* by the French, from whence our word *camlet*, afterwards applied to an inferior stuff made in imitation of it.

**Cambridge Asylum, Royal**—An institution founded by the father of the present Duke of Cambridge to form a home for one widow of each British regiment. It is not yet completed, and is only capable of receiving, at present, about 50 widows.

**Camel**—A beast of burden used in certain parts of India to carry the baggage of troops. The utility of camels for this service is confined to those parts of India where the climate is very dry. In a damp, marshy country they are useless. A camel can carry four maunds, or 320 lbs., the usual length of a march, without being distressed.

**Cameronian Regiment**—The 26th regiment of the line in the British army. It appears from 'Chambers's Encyclopædia' that it owed its origin to a body of brave and spirited hillmen or Cameronians who were induced by the convention, which sat at Edinburgh during the revolution of 1688, to give their services in assisting to complete the work of the revolution, which, as was still imagined by some, was to re-establish things according to the letter of the Covenant. To keep down therefore such a movement, a regiment of Cameronians was organised, each soldier being induced to join with the understanding that the special object of the corps was to establish the work of the Reformation in Scotland.

**Camouflet**—A small mine charged with about 10 lbs. of powder, sufficient to compress the earth all around it, without disturbing the surface of the ground. It is sometimes formed in the wall or side of an enemy's gallery, in order to blow in the earth, and to cut off the retreat of the miner.

**Camp**—The whole extent of ground occupied by an army either in huts or under canvas. The breadth should not exceed the length of line occupied by the troops, when drawn out in order of battle. With regard to the situation of camps, it is a general rule that both wood and water be near at hand. Camps are either *permanent* or *movable;* in the former case the troops live in huts made of wood, as in the camps at Aldershot, Shorncliffe, and the Curragh. Artillery, as well as cavalry, in selecting a position for a camp, should get as near water as possible, with reference to the supply required for men and cattle attached to batteries, which amounts in a temporary camp for each man to ten pints a day, for each horse to ten gallons a day. The minimum quantity to be calculated on is six pints and six gallons, but in a stationary camp more water will be required, viz. five gallons per man and fifteen per horse. Troops should avoid pitching their camp too near a village, in case of fire, and pitch always to the windward of it, if possible. High and dry ground should also be selected, and it is an axiom in selecting ground for an artillery camp that there should be a clear space to its front. In standing or flying camps, great attention should be paid to sanitary arrangements; but it is to be borne in mind that there is an important distinction between camps for a night and permanent ones. Then, again, in modern times, troops would never encamp in presence of an enemy; they would merely bivouac.

In standing camps, the regulated intervals must always be kept, viz. 10 paces between each tent, and between regiments and brigades increased intervals; indeed large open spaces should be kept, and, further, when camps are not near the enemy, they should be spread out as much as possible, but in camps pitched for one night everything should be compact.

The ground generally chosen, and if available, should be commons, unenclosed grass lands, heaths, ground never turned up. Low marshy flats should be avoided; gentle sloping ground to north and east is advantageous. Brushwood, as it generally covers damp ground, is to be avoided. Woods are bad for a camp, but good for a bivouac.

The next thing to be thought of is the soil a camp stands on:

Sand and gravel is good;
Chalk is fair;
Clay is bad.

Sites of old camps had 15 to 20 acres per 1000 men for a passing camp; twice that space for a permanent. The communications should be to the main road, and within the camp.

In laying out a camp, say a standing camp, it should not exceed in length a line of battle.

For the room taken up in standing or marching camps, *vide* 'Regulations and Instructions for Encampments,' 1872.

It appears that in the Prussian military system encampments are always square in form, no matter what the number of troops on the ground. The camps are guarded by sentinels scattered on the fronts and wings from 30 to 40 paces from each other.

**Camp Equipage**—Are all articles which are required by troops on the march, such as tents, utensils of all sorts, camp kettles, stretchers, ambulances, &c., in fact, all such things as an army would require in the field. They are provided by the Control Department.

**Camp Followers**—The sutlers, petty tradesmen; servants, and all others who accompany an army in the field. In India the camp followers are very numerous, and of a mixed nature—their numbers quadrupling sometimes those of the whole force. It is difficult to diminish the numbers which follow a camp in India, seeing that officers' servants alone form a very large number of the camp followers. Then all these have to be fed, which necessitates a class of men following the camp whose trade is to provide such articles of food and clothing as the numbers in camp require.

Armies in Europe have also camp followers, but not, fortunately, to the extent of an Indian army. All camp followers are subject to the Articles of War, whether at home or in India.

**Camp Kettle**—In camp equipment, a vessel of iron or other metal in which the soldiers' food is cooked on the march. There are two patterns in the service—*Torrens* and *Flanders;* the former is used in standing camps, as it is of larger capacity than the latter.

**Campaign**—A period during which an army keeps the field and carries on a series of operations.

**Camphor** (*Laurus camphora*)—An exudation from the Indian laurel-tree, having a fragrant smell. It is chiefly found in China and Japan, and is in appearance white and transparent, of a light and highly inflammable nature, and, in consequence of its combustible powers, is used in fireworks. It is soluble in spirits of wine. As a preservative of cloths of every kind against insects, it is a valuable article.

**Canal**—An artificial channel for water, formed for purposes of navigation, and, when available, is taken advantage of for transport of military *matériel.*

**Canister** or **Case Shot**—Ammunition which is used with all natures of ordnance. It consists generally of a tinned iron cylinder filled with sand, shot, or balls made of lead and antimony packed in sand and clay. The balls vary in weight and diameter, from 4 lbs. to 1½ oz., according to the nature of the ordnance for which they are intended. Canister is used in lieu of grape shot, which was in general use some years ago, but is now obsolete. It is a question, in these days of long-range rifles, whether case shot, which may be said to be only effective at 500 yards from rifled guns, will be so valuable as it has hitherto been. Its value, with rifled guns, would appear to be, to be used as a last resource in case of a sudden rush by the enemy to capture the guns. Experiments with case shot show that much better results are obtained by firing two case shot than one, at moderate ranges, viz. up to 450 yards.

**Cannon**—A piece of artillery used to throw balls and other projectiles. The term cannon, as stated by some authors, is derived from *canna* (a reed). The first cannon were called *bombarda*, from the great noise which the firing of them occasioned. They were nothing more than bars of iron, arranged in such a manner that their internal aspects should form a tube: the bars were not welded, but merely confined by hoops. On some occasions, expedients much less efficient than this have been had recourse to, cannon having been made of coils of rope arranged in a tubular form, and even of leather or wood.

The first use of cannon is thus alluded to in Lieutenant-Colonel Luard's 'History of the Dress of the British Soldier,' in detailing the weapons used during the reign of Edward III.:—"Fire-arms were introduced in this reign, and cannon were used at the siege of Puy Guillaume in 1338, and in the English expedition against Scotland in 1337; but it is doubtful if any were used at Cressy, which battle was fought in 1346."

Captain Duncan, in his 'History of the Royal Artillery,' remarks with reference to the introduction of cannon that "the moral influence of the guns was far beyond their deserts. They were served in the rudest way, and their movements in the field were most uncertain, yet they were regarded with superstitious awe, and received special names, such as 'John the Evangelist,' 'The Red Gun,' 'The Seven Sisters,' 'Mons Meg.'" The same author states that "the first mention of casting in England of great brass cannon and *culverins* is in the year 1521, when one John Owen began to make them, the first Englishman that ever made that kind of artillery in England." The first iron guns cast in this country were made by three foreigners at Bickstead, in Sussex, in the year 1543.

**Canteen**—A regimental establishment for the supply of wine, malt-liquor, groceries, and other articles, to the soldier at reasonable prices. It is managed by a committee of officers. For the use the profits of a canteen should be put to, and the rules and regulations regarding such an establishment, *vide* Queen's Regulations. This term is also given to a soldier's mess-tin, carried on the knapsack, and is further given to a box or case, waterproof or otherwise, in which an officer carries his table or cooking utensils.

**Cantonments**—When troops are detached and quartered in different adjacent towns and villages, they are said to be placed in cantonments. In India, the permanent military stations are so called, and in that country a cantonment contains barracks for European troops, and native huts termed *lines* for the Sepoys. The European officers live for the most part in bungalows or thatched houses. Regimental bazaars also form part of the adjuncts of a cantonment.

**Canvas**—A material made from hemp, and much used for artillery purposes, such as the covering of the seats of gun-carriages, caps for sponge heads, soldiers' bags, aprons for the vents of guns, and paulins for covering stores; it is also used in the manufacture of tents. The canvas in use in arsenals in India is of two kinds—English and that manufactured in the country. The canvas made in India is used for all purposes where rough material would be required, such as artillery practice curtains, sand-bags, bags for charcoal, &c. The chief places of manufacture of Indian canvas are in Bengal, and at Cuddalore and Travancore, in the Madras Presidency.

Being "under canvas" means being in camp or in the field.

**Cap-a-pie**—This term was applied in the middle ages to a knight or soldier armed at all points, or from head to foot, as the words imply, with armour for defence, and with arms for offence.

**Cap Square**—In artillery, that part of the iron work of a gun carriage which folds or laps over the exterior portion of the trunnions of a piece of ordnance, when it is laid in its bed or carriage. The cap square is secured by a key or some other stronger contrivance. This fastening prevents the gun from jumping out of its trunnion bed.

**Capital**—In fortification, is a line drawn from the angle of the polygon to the point of the bastion, or from this point to the middle of the gorge. It bisects the salient angle of a work.

**Capital Punishment**—In the army, the sentence of death passed by a court-martial for certain offences committed by officers or men. (*Vide* Articles of War.) Capital punishment is inflicted by the offender being either shot or hanged, the latter being resorted to for some scandalous or infamous crimes only.

**Capitulation**—The surrendering of a garrison or an army on stipulated conditions. As shown by Major Knollys in his 'Handy Dictionary of Military Terms,' it is the fact of terms being granted which makes the difference between capitulation and surrendering.

**Caponier**—In fortification, is the passage from the body of a place to an outwork. It is of two kinds, *single* and *double*, and is either covered or uncovered; in the former case, generally bomb-proof, and the sides loop-hooled.

**Caps, Canvas**—Used, after being waterproofed, for covering the mouth of mortars, and for covering sponge staves.

**Caps, Percussion**—Small cylinders of copper, closed at one end, in which a small charge of fulminating powder is placed. They are used to ignite the charge in small-arms. The military percussion cap differs slightly from the ordinary sporting cap in having a flange round the open portion or rim of it, to enable the soldier to take a good hold of the cap. This form of cap was in very general use before the introduction of breech-loaders. The shape, however, has been somewhat changed, as may be seen in the copper chamber of the present small-arm cartridge, which contains a copper cap, with the usual cap composition. Percussion caps are made by machinery driven by steam. The process in the manufacture of the original cap is as follows:—Sheets of 16-oz. copper, or copper weighing 16 oz. to the square foot, are cut up into strips, three inches broad, and passed into the machine for receiving them, which, from that moment, converts them, by a very speedy and ingenious process, into caps ready to receive the fulminating charge; they have, however, previously to be washed in diluted sulphuric acid, to free them of all red oxide which may remain on the surface of the copper. The caps are then washed in clean water, and boiled in a solution of pearl ash to remove the oil. The machine that forms the caps turns out at every beat of its progress three or four caps at a time, and the speed with which they can be made depends upon the regulation of the steam power. After the caps have been steeped in diluted sulphuric acid for some time, they are dried, and placed on gun-metal plates, holding a regulated number of caps ready to receive their charge; this is accomplished in the loading room; they are then removed from thence to the compressing machine, after which they are taken to the varnishing machine to fix the charge in the caps. This machine is so adapted that each cap receives one drop of varnish composed of spirits of wine and shell lac. The plates are then removed and placed on steam baths, to dry and fix the varnish. Glazing, if carried out, is effected by the slight pressure of a spindle upon the charge. The caps are now closely examined to see that each has received its charge, and afterwards weighed, and packed away in tin boxes.

**Capstan**—A strong massive piece of timber, the upper part of which is pierced with holes for the reception of bars or levers to which the power required is applied. Round the capstan a rope is coiled, to the end of which the weight to be lifted is attached. In default of a capstan an artillery wheel can be made to take its place.

**Captain**—In the army, an officer who commands a troop of horse, or a company of infantry. The title of captain was first used to denote the chief or head of a company of troops or body of men. In the artillery there is a captain appointed to each battery, but he has no independent command. He is now simply second in command of a battery. Formerly the commander of a battery was a captain, and a second captain was attached to each battery to aid him in his duties; but on the re-introduction of the rank of major in the artillery, the commander of a battery became a field officer, and the name of second captain was abolished for that of captain.

In the engineers, the same change has occurred. In the militia and volunteers batteries of artillery are still commanded by captains.

In the guards the rank of captain gives also the rank of lieutenant-colonel, and the latter is therefore captain and lieutenant-colonel.

**Captain-Lieutenant**—A rank formerly held in the army. This position carried the rank of captain in the army, similar to what the rank of lieutenant and captain does in the foot guards at the present day. A captain-lieutenant did subaltern's duty in his company, and could hold the post of adjutant. He was also the subaltern who commanded the "colonel's company" in each regiment of infantry.

**Carabiniers**, or **Carbineers**—All regiments of light-armed horse were formerly thus called, but since the establishment of hussars they have lost that appellation. They are said to have derived their designation from the Arabs, amongst whom the Carabins or Karabins were light horsemen, stationed at out-posts to harass the enemy, defend narrow passes, &c.; in action they took the place of skirmishers. There is only one cavalry regiment in the service, the 6th Dragoon Guards, which bears the name of Carbineers. The first regiments of carbineers were raised in the reign of James II.

Troops called *Carabins*, a sort of light cavalry from Spain, are first mentioned in England in 1559.

**Carbine**—A small-arm rifle of shorter dimensions and less weight than a musket, and used by both cavalry and artillery. The carbines in the service are of two kinds, muzzle and breech-loading. The converted Enfield rifled carbine, now the Snider, is the arm used by the artillery and cavalry, except the lancers. The royal engineers use Lancaster's converted breech-loader. In Appendix F is shown what troops use the muzzle-loading carbine rifle.

**Carbon**—Is found in many minerals and in most vegetable and animal substances. Carbon, or pure charcoal, is found in its pure state in the diamond. As charcoal, it burns quickly and strongly, and preserves its heat for a long time. Carbon abounds in coal, but mixed up with iron, sulphur, and other bituminous constituents. It is also one of the elements which forms carbonic acid with oxygen.

**Carcasses**—Shells of greater thickness of metal than common shells of the same diameter, and having three vents instead of a fuze hole. These holes admit of the burning composition, with which the shells are filled, acting with great force and vigour on whatever the shells may fall. Carcasses are chiefly employed in bombarding towns, harbours, &c., and may be fired from mortars, howitzers, rockets, or S.B. guns, but, generally speaking, they are fired from mortars. They burn for the space of eight or ten minutes, and the nature of the composition is such that they will burn under water. Carcasses are fired with service charges, except the 13- and 10-inch carcasses, which are fired with 16 and 9 lbs. respectively.

**Carriage, Beam,** *vide* Beam Carriage.

**Carriage, Block-trail,** *vide* Block-trail Carriage.

**Carriage, Depression,** *vide* Depression Carriage.

**Carriage, Drug,** *vide* Drug Carriage.

**Carriage, Moncrieff**—A barbette-traversing carriage, invented by Major Moncrieff, of the Edinburgh Artillery Militia, having for its object the power of mounting guns with counter-weights, of using them in gun-pits, and of laying them with reflecting sights.

In a lecture given at the United Service Institution, a few years ago, by Major Moncrieff, he explained that since the introduction of rifled guns and small-arms, the protection afforded to the artillery and the detachment serving the guns in battery was not proportionate to the increased power of the fire of arms of precision, and that the necessary protection, such as casemates and turrets afforded, could not be made available except at great expense, and even then at the sacrifice of range of fire. It was apparent to him, therefore, that if extended range were required, guns must still be mounted *en barbette*, thereby necessitating the exposure, whilst loading, of the gun detachment.

The principle of the Moncrieff invention is this:—

"By a simple application of counterweight with a moving fulcrum, the carriage lowers the gun out of fire. The gun of its own accord rises into the firing position, the energy of the recoil being stored up to make it do so."

The advantages, as set forth by the inventor, are as follows:—

"It enables a small gun detachment, behind a mound of earth, to load and point the gun in this protected position without being seen.

"To fire the gun without the men being exposed.

"It effects an enormous economy of labour, material, and life.

"From the fulcrum between the gun and counterweight being a movable one, the jar and shock caused by firing, and transferred by friction to the platform, are avoided.

"It is only exposed to direct fire during the short time required to discharge the gun, which, on firing, descends of its own accord out of harm's way."

The following is a description of the Moncrieff wrought-iron garrison carriage for the rifled M.L. 7-inch gun, as approved of by the War Department:—

"The apparatus may be described, generally, as consisting of a carriage proper attached by a shaft to one end of a curved elevator which has a counterweight, consisting of iron ballast, packed in boxes at the other end. These are placed on a low traversing platform, which is fitted with guide rails supporting the rear of the carriage, and with friction traversing gear.

"Upon the gun being fired, the force exerted by the recoil raises the counterpoise, and the gun descends until it is brought to rest below the level of the parapet. It is there detained by self-acting pawls contained in the break drums; the gun is run up by raising weighted levers and allowing the break drums to revolve by the reaction of the counterweight until the gun reaches the firing position."

For naval purposes, Major Moncrieff has also invented a means of raising and lowering guns from the lower to the upper deck, and *vice versâ*, by the introduction of the hydro-pneumatic carriage, but, as he explained in a recent lecture, this new contrivance is as different from the system now adopted for land service as could be imagined; there is in it neither a moving fulcrum nor a counterweight, which are the grand characteristics of the land service carriage. Instead of using the force of gravity, pneumatic agency is employed as the balancing force, and the recoil is absorbed by the same agency.

**Carriages, Artillery**—Embrace all carriages for the transport and service of guns, their ammunition, and stores.

Those on which land guns are mounted are of three natures—*field*, *garrison*, and *siege*. Since the introduction of M.L.R. guns, the carriages are made of wrought iron, though there are still wooden carriages in the service; but these will be superseded by degrees. For the manufacture of all natures of gun carriages in England, Woolwich possesses one of the finest factories in the world, in which naval as well as military carriages are made up. This factory or carriage department of the arsenal, as it is properly termed, was first organised in 1803, and has gradually developed into a first-rate establishment, possessing of late years every means, mechanical and otherwise, for manufacturing carriages in the most expeditious and approved manner.

**Carriages, Field**—Carriages on which the lighter natures of ordnance are mounted, and on which they travel, and from which they are fired. They consist of the gun carriage, the limber and ammunition wagon. In the home service, and partly in the Indian service (until within the last few years), the field batteries were composed of 12-pr. and 9-pr. B.L. rifled guns (Armstrong), mounted on wooden carriages, but since the introduction of the present M.L.R. guns, wrought-iron bracket carriages have been constructed, the axle-trees and axle-tree beds of which are combined in one. The advantage of this construction is its increased strength.

**Carriages, Garrison**—Carriages constructed for such guns and howitzers as are not intended for transport, and which are generally placed on the ramparts of a fortress or in casemates and other fortified buildings. The old-pattern carriages are made of cast iron. Since the introduction of heavy rifled guns, the patterns of garrison carriages have been modified to suit the nature and weight of the ordnance, as well as the position in which they are to be placed. They are now made of wrought iron, with sliding carriages of the same metal. To check the recoil, an hydraulic buffer is attached to each; this buffer is entirely self-acting, and when once filled with refined petroleum oil, known as Rangoon oil, requires no farther adjustment.

**Carriages, Mountain**—Carriages on which guns used in hilly countries are mounted. The pattern carriage in use is the *bracket*, made of steel, and light enough, that for the 7-pr. gun, of 150 lbs., to be carried on a mule. The carriages for the heavier mountain guns are of the same pattern, but with some slight alteration.

**Carriages, Muzzle-pivoting**—The object of this system is to give elevation and depression to the gun without movement of the muzzle. This is especially an advantage where the height of the ports in iron ships is limited, and also where it is desirable to give greater cover to gun detachments. Three systems, it appears, have been tried, but not favourably reported on. The reason muzzle-pivoting has never succeeded is stated by Major Morgan, R.A., in his lecture before the United Service Institution in 1874, to be "because the centre of gravity of the whole mass of the gun has to be raised. The only way in which it can satisfactorily be accomplished is by the Moncrieff principle, or some such modification. With my gun, however, the trunnions have merely to be fixed in the turret, and the whole question is solved."

As some of our iron forts are constructed with small ports, the best of the three systems will probably be adopted, and that of Colonel Inglis's appears to be the best. The following extract from Major Griffith's 'Artillerist's Manual' will explain the mode of elevating and depressing the gun:—"Elevation and depression is given in the usual manner, but the trunnions are supported on screw-jacks, by means of which the gun can be raised or lowered. The port is constructed to give an amount of elevation equal to from 0° to 5°. Let us suppose for instance that, with the gun in a certain position, elevation can be given up to 5°, and that 10° is wanted. Elevate first to 5° (the muzzle will be near the top of the port), and then lower the gun, by means of the screw-jack, till the muzzle nearly touches the sill of the port. The gun will still be at 5° elevation, and 5° more can be obtained by elevating in the usual way. Captain Scott's carriages for turret-guns are constructed nearly on the same principle."

**Carriages, Siege**—Carriages of the bracket-pattern on which siege guns are mounted. Hitherto they have been made of wood, but wrought iron, which is fast superseding wood material, is to be used in the manufacture of all carriages of this nature, as has been the case in all field carriages of a late construction.

A hydro-pneumatic carriage has also lately been proposed by Major Moncrieff for the use of siege carriages, somewhat on the system of his counterweight carriage for heavy guns. The object obtained is lightness, the facility of loading the gun out of sight of the enemy, and raising it *en barbette* without any difficulty, thus obviating the necessity of cutting embrasures in the parapet. The following description of the method of using the hydro-pneumatic system is herewith given extracted from a recent number of the *Times*:—

"The carriage is designed for siege purposes, and it seems not improbable that the development of its principle may altogether revolutionise that branch of military operations. Batteries of attacks have hitherto been protected by embankments hastily thrown up, while the guns have been fired through embrasures. But the deadly precision of improved artillery sends shot after shot into the embrasures, while its penetrating power makes ordinary earthworks but very indifferent protection. Major Moncrieff's idea is to adapt to the attack the system he has been elaborating for our coast defences. He digs a hole and buries his gun in it. The soil, when it is excavated, is carried to the rear, and the enemy has no mark to guide his aim; after each discharge the gun sinks out of sight, and the indication of its precise whereabouts vanishes with the smoke. In the sieges in the late war the Germans found that they must withdraw their batteries to immense distances, whence the fire was vague and relatively ineffective. Major Moncrieff undertakes to place his guns within 500 yards of the enemy's works. By his well-known idea of the counterweight he had attained his object of elevating the gun out and returning it to cover, and so enabling the gunners to work in comparative safety by storing the force of the recoil. But the objection to applying the system to siege operations was the unwieldy weight of carriages fitted with the counterweight, where lightness and facility of movement were primary considerations. The hydro-pneumatic system dispenses with this ponderous counterweight, replacing it ingeniously with a simple cylinder only containing air and water, which oscillates between the cheeks of the gun carriage.

"It is a feature in the carriage that it can be secured on an improvised platform without any heavy and costly appliances. It was fastened, as it is intended to be fastened in actual service, by a chain passed loosely round some balks of timber buried in the ground, and the fastening acts as a rude pivot, on which it revolves. The gun was a rifled muzzle-loading 64-pr.; it was fired with 12 lbs. of powder, and the carriage very much resembled an ordinary siege one. When in position for firing, the gun is raised to a height of some 7 feet upon a pair of arms or elevators which lay hold of the trunnions, and their action is regulated by racks, which are arranged to work in connection with a radial connecting rod. Between these is the head of the piston which works in the hydro-pneumatic cylinder. With the discharge of the gun the head of the cylinder sways backwards, the piston is forced down by the recoil, and, as the piston slowly goes down in this cylinder, the gun descends with it to the normal position for loading. The internal adjustments of the cylinder are, of course, the essence of the invention. The piston descends in a tube of water, communicating at the bottom of the cylinder with a couple of side chambers which are filled with air. As the water is forced down in the central tube, it necessarily rushes into the side ones, and the elasticity of the air it violently compresses is the motive power that is to be stored for use. There is just sufficient water to fill the central cylinder and to cover all the valves and joints, and there is nothing but strong and solid metal in those parts of the side chambers in which the compressed air is to be confined. At the bottom of the cylinder, between it and the air valve, and immediately in rear of the latter, is a 'throttle valve.' The throttle valve consists of a small, circular, perforated cylinder, revolving within a larger one, and its purpose is to neutralise, by the application of water friction, any excess of energy in the recoil. Indeed, next to employing air and water, as light and convenient materials of enormous power to work those heavy siege guns, the idea is to use those elements so as to avoid friction and concussion. Instead of the violent recoil which threatened to shake the strongest carriage to pieces when it was arrested sharply by the resistance of screws and iron, according to this hydro-pneumatic system the recoil is made to exhaust itself upon air springs and water cushions. The first shock is broken upon the mass of water in the middle cylinder, and the throttle valve disposes, as it were, of any of the subsequent vibrations. Theoretically, therefore, if we may use the expression, the recoil should be all self-contained. It was very nearly so in practice; the carriage moved slightly to the first shot, as the chain tightened that secured it to the timber balks; but the shot that followed made no perceptible change in its position. It must be remembered that under the old system, and before Major Moncrieff had invented his counterpoise, or thought of his hydro-pneumatic cylinder, the gun would have wrenched itself away from any such rough and ready fastening. When the piece is raised for firing, it is managed by a worm-wheel at the side, which regulates the angle of elevation, and which turns easily to the touch of a lady. To sum up the merits of the invention, if it realises the advantages claimed for it—and as it is confessed to be a mechanical success, we scarcely see how it can fail to do so—it will enable siege batteries to be established and worked with comparative impunity at an extraordinary short distance from the formidable guns which are mounted on modern fortresses; siege guns may be secured in position anywhere with materials that are always ready to hand; and carriages on constant service will be exposed to the very *minimum* of strain. Moreover, Major Moncrieff's new apparatus can be easily adapted to ordinary siege carriages, and a cart and a couple of horses will transport its extra weight. If it proves successful with the heavy 64-pr. siege guns, *a fortiori* it must succeed with the 40-pr. to be employed for our coast batteries, as suggested in Major Moncrieff's pamphlet on our national defences, published by Stanford. We may add that the invention has the warm approval of such distinguished military engineers as the Austrian Icholl and the Belgian Brialmont, and those authorities on the art of war are not men to commit themselves to an opinion lightly."

**Carrier-Pigeon**—The name of a species of pigeon which is used in war time to convey messages to any particular city, post, or detached wing of an army. During the campaign of 1870 between France and Prussia, carrier pigeons were constantly used by the French. In a French work lately issued, the subject of messenger pigeons has been revived, showing that the birds known as homing-pigeons supply the most simple and the most practical means of transmitting orders to a distance during military operations. The work, which is by M. du Pay de Podio, commandant au 48$^e$ de Ligne, goes on to show that white is the best colour for a carrier-pigeon for the reason mentioned in his book. He then goes on to state the treatment and management of these birds, and how they should be reared. He considers they are far more reliable for transmitting messages than balloon-post. It is stated (1874) that the French military authorities have decided upon following the example of Russia, Italy, Austria, and Germany, in organising a regular pigeon telegraph. This example might well be followed by England. Carrier-pigeons are said to have been used by the old Roman navigators before the days of the Cæsars, and there is no reason why it might not be worth while to revive their use on board the Transatlantic steamers.

**Carronade**—A piece of ordnance invented by Mr. Gascoigne, but now obsolete. The carronade took its name from the Carron Foundry in Scotland, being the first kind of ordnance cast there, and was introduced into the service in 1779. Carronades are short pieces of ordnance, and have less metal than guns of the same calibre, being intended not so much for long ranges as to project shot of large calibre with accuracy to such distances as vessels of war in those days were supposed to engage at, viz. from 400 to 600 yards. These pieces have no trunnions, but are cast with a loop underneath, a bolt passing through attaching them to their carriages. They have no swell at the muzzle, but an enlargement of the bore or cap to facilitate the putting in of the shot, and to save the rigging and hammock nettings on board ship. They have a sight on the reinforce ring, and their chambers are cylindrical; the charge is one-twelfth the shot's weight.

**Carry, To**—In a military sense, is to obtain possession by force; hence "to carry by assault."

The term "carry arms" is used in the manual and firing exercises, and is the position a soldier brings his firelock to, as a mark of respect, when an officer passes his post.

**Cart**—A frame-work of wood, with sides, front and end boards, placed upon two wheels, and drawn by one or two horses. In the artillery, carts are very generally used. A new-pattern cart was introduced a few years ago into the service for the carriage of small-arm ammunition in the field. There are about eighteen carts in the service of different patterns and for various purposes.

**Cart, Hand**—A cart used for carrying ammunition and stores, especially in the supply of advanced batteries, when wagons cannot conveniently approach. The hand cart will carry a load of 15 cwt.

**Carts, Transport**—Carts used for the conveyance of stores of all natures both of food and ammunition, and for the carriage of the sick. When an army takes the field, the control department has the selection and provision of carts for the carriage of the stores, tents, &c. In the selection of carriages, that which travels the easiest and lightest is to be preferred. Two-wheel carts form admirable transport, and have the following advantages:—

Horses nearer their load, and therefore easier draft;
Easier driven;
One kind of wheel;
Easier extricated in heavy ground;
Carry more in proportion than four-wheel carts;
Go over worse ground.

The best pattern is the Maltese cart, which stands high enough to be drawn by large-sized mules.

**Cart, Trench**—A modification of the hand cart. It is smaller than it, but stronger, and can be used for carrying 10-inch or smaller mortars and their beds. It is fitted with shafts for single draught.

**Cartouch, Gun**—A waterproof canvas case for holding the cartridges of a field battery. There is one to each ammunition box. Copper cartouches were formerly in use in the Indian batteries; and for damp climates, such as Assam and Burmah, they will be found to be more serviceable than canvas.

**Cartridge**—A case or bag containing a charge of gunpowder or gun cotton, which is used to propel bullets or larger natures of projectiles from small-arms and guns.

**Cartridge, Buck-shot**—A cartridge used with M.L. and B.L. Snider arms of ·577 bore. The former consists of two paper cylinders, one containing 2½ drachms of R.F.G. powder, the other containing twelve buck-shot, weighing about 220 to the pound. Buck-shot cartridges for B.L. arms are similar to the one described. These cartridges are issued in this country to convict warders.

**Cartridge Cases for Guns**—Cases for bringing cartridges up to the gun from the magazine. They are made of leather for S.B., B.L.R. and M.L.R. guns, up to the 9-inch; but for the 7-inch M.L.R. guns and upwards, zinc cylinders are used.

**Cartridge, Drill**—A dummy cartridge used for drill purposes with ordnance. For B.L. ordnance it is made of leather. The interior consists of a wooden cylinder, packed round with felt and a wooden dummy lubricator of such length and diameter as, when covered with leather, to form a cartridge of the same dimensions as the service cartridge. A copper plate is fixed at the base to prevent injury from the explosion of the tube. For M.L.R. guns, raw hide is used to cover the half wood block.

**Cartridge, Gun**—A bag in which the charge of powder is placed before the cartridge is inserted in the gun. The size and form of cartridges depend on the nature of the guns with which they are to be used, and the purpose for which they are required. They are made of serge, silk (a material made entirely from refuse silk), and raw hide—serge for service, silk for saluting or exercising, and raw hide for drill purposes. Experience has shown that serge is hardly strong enough for heavy charges; silk cloth, therefore, which is much stronger, is likely to take its place. Serge or flannel cartridges are hooped (stitched round with rings of thread or broad braid), which tends to keep them in their proper shape when filled.

In examining cannon cartridges (filled or empty) care should be taken to see that the flannel is perfectly sound throughout, and the sewing uninjured, and free from all appearance of moth. If filled, the powder should be free from all lumps or dust. Dust in powder in any package or parcel of cartridges will be shown by the flannel appearing black and dusty on the outside.

To restore the cartridge, if the powder has become caked by pressure, gentle rolling will bring it to its proper state; but if it has been caked from wet, it cannot be restored without injury to the grain.

Cartridges which are injured by moths, or have the flannel torn or damaged, or of which the powder has been wetted and caked, or which is very dusty, are unserviceable.

**Cartridge, Martini-Henry,** *vide* Bottle-necked Cartridge.

**Cartridge, Small-arm**—Consists of a cylindrical case, in which the exact charge of the musket or rifle is placed, including the bullet.

The new service cartridge is that used with the Martini-Henry rifle, the small-arm lately issued to the British army. The cartridge is similar in general construction to the cartridge for the Snider arm. It is thus described in the 'Changes in War Material' for September 1874, as follows:—

"The bullet is made of an alloy of 12 parts lead and 1 part tin. It has two cannelures, is papered, and lubricated with beeswax. The weight of the bullet is 480 grains.*

The case is made of sheet-brass, 0·004 inch in thickness, partially covered on the inner side with tissue paper attached by cement. It has also a small band of sheet-brass, 0·004 inch, riveted on its inner side in such a position that when the case is rolled up, it will be between the folds so as to prevent 'cutting' at the top of the base cup. There is a small hole pierced through the case in order that it may be seen if the band is in its proper position. After the case is rolled, the top end is reduced in diameter by crimping from ·577 inch to 0·45 inch.

The charge of powder is 85† grains; the manufacturing limit being ± 2 grains. On the top of the charge is a glazed board disc, with a concave beeswax wad attached, on the top of which two more glazed board discs are placed; the bullet is then inserted and secured by choking the case into the two cannelures.

The remaining parts of the cartridge are the same as in the cartridge for the Snider arm."

**Cascable**—In artillery, that portion of a piece of ordnance in rear of the base ring; it is composed generally of the button, the neck, neck fillet, and the base of the breech. This description has reference to S.B. guns, rifled guns having no such mouldings, but heavy M.L.R. guns have a cascable, which is screwed in at the rear of the gun, and fits evenly against the end of the steel barrel. The cascable has a button through which a hole (which is afterwards enlarged into the loop) is drilled through one end, for the purpose of screwing the cascable into the gun.

**Cascable Hitch**, *vide* Clove Hitch.

**Case-hardening**—An operation of great importance in the treatment of iron, whereby a thin casing of steel is given to it, and the conversion can be carried to an extent which leaves the central parts of the metal in their original condition of soft fibrous iron, or of cast iron.

---

* Has been reduced to 410 grains.

† Reduced to 80 grains.

**Case Shot**—Another name for canister. This nature of ammunition is fired from all ordnance. *Vide* Canister.

**Casemate**—A chamber made within the ramparts of a fortification, to contain a number of guns, embrasures being cut for them through the revetment; in some systems its particular use is to defend the ditch. Casemated batteries are generally used on the sea faces of works, and in defending the entrance of harbours, in which case they consist of a bomb-proof arch, open to the rear. Iron plating and shields of various thickness are used in the protection of the embrasures.

**Cashiering**—The dismissal of an officer by a court-martial for dishonourable or disgraceful conduct, whereby he is rendered incapable of serving the sovereign for the future in any military capacity.

**Cask**—A round wooden vessel, of more length than breadth, bulging out in the middle, and closed up at either end. In military operations, casks are used to form bridges across rivers when no pontoons can be had. They should be about 4 feet 3 inches long, and diameter at head and bulge, 2 feet 2 inches and 2 feet 9 inches respectively, which is the size of the water butts of the navy; but any barrels available will answer. Casks filled with earth may also be used as gabions on an emergency, and also in the erection of barricades when it is necessary to build a revetment.

**Casque**—The French name for helmet, and which in ancient armour was the name by which that headpiece was known.

**Cast Iron**—The oxide of iron, which, in the process of fusion, gives off a certain amount of oxygen, and combines with the carbon, the result being cast iron, which is fusible, but brittle. It is obtained from the ore by smelting, freed of many of its impurities, and run into moulds, from which it receives the name of pig-iron. Cast iron has been largely used, until very lately, in the manufacture of iron ordnance. It is observed to be of three kinds, *white*, *grey*, and *black*. White cast-iron is useless for the manufacture of guns, from its very brittle quality. Its white appearance is owing to the small quantity of carbon in proportion to the metal. Grey cast iron is a less brittle metal, containing more carbon than the white metal. This was the kind made use of in casting guns. Black cast iron contains a large quantity of carbon, which gives it the colour named, and renders it, by its excess of this quality, very fusible, but not tenacious or cohesive, and hence not fit for ordnance purposes. Cast-iron guns, having become nearly obsolete in the service, are no longer manufactured.

**Cast Steel**—Blistered steel, which on being fused and cast into ingots becomes more uniform in texture and of superior quality, from the more equal distribution of carbon throughout the mass. The best kinds of cutlery are formed of cast steel.

**Casting**—In foundry, the running of liquid metal into a mould prepared for that purpose. Pig-iron and gun-metal are so treated in the manufacture of cannon, iron-work, &c., also in the casting of shot and shell. The process pursued in casting guns is to pour the fused metal into a mould of the shape of the gun required; and in casting what is termed "solid," the liquid metal enters in at the bottom of the mould, which is placed in a pit at a convenient distance from the furnace in an upright position, muzzle upwards. With reference to the interval that should be allowed to elapse before casting, after fusion takes place, opinions differ. Mr. Mallet, in his valuable work on the 'Construction of Artillery,' says:—"The lower the temperature at which the fluid cast-iron is poured into the mould, and the more rapidly the mass can be cooled down to solidification, the closer will be the grain of the metal, the smaller the crystals, the fewer and least injurious the planes of weakness, and the greater the specific gravity of casting."

The term "casting" is also applied in a military sense to the weeding out of old, diseased, or incapable horses in the government service. Horses so found are sold by auction to the highest bidder on account of government.

**Castle**—In a military sense, a fortified place or stronghold to defend a town or city from an enemy. The oldest castles in England date as far back as the military occupation of the country by the Romans, or even before then, as traces of castles are found in various parts of the country, chiefly on the tops of hills, which are ascribed to its aboriginal or early inhabitants. It is probable, as shown in 'Chambers's Encyclopædia,' that the Saxons took the Roman castles as a model for their own system of defence; and traces of Saxon and even Norman workmanship are found in structures which are believed to have been originally Roman.

**Castrametation**—The art of regulating and laying out the encampment of troops of all kinds, whether the troops are to be hutted, placed under canvas, or bivouacked. For detailed information on the subject of encampments, *vide* 'Regulations and Instructions for Encampments,' 1872.

**Catapulta**—A warlike machine, used in ancient times for projecting stones, long darts, or javelins. There were different kinds and sizes of catapultæ to which names were given. The smaller kinds were in the form of a cross-bow; the larger were supported by a frame which sustained two arms moving horizontally, having for a motive force two skeins of catgut. The catapulta was less powerful than the balista, but more uniform in its range. Catapultæ have occasionally been used in modern warfare. There was one erected at Gibraltar by General Melville, for the purpose of throwing stones a short distance over the edge of the rock in a particular place where the Spaniards used to frequent, and where they could not be annoyed by shot or shell.

**Catgut**—A cord made from the intestines of animals. It is used for turning-lathes and all narrow-grooved wheels in machinery.

**Cat-o'-nine-tails**—A whip with nine knotted cords. It is occasionally used in the British service for the punishment of soldiers convicted of heinous crimes.

**Cat's-paw**—The name given to a particular turn made in the bight of a rope, to which a tackle is fastened.

**Cavalier**—In fortification, is a work constructed in the interior of a full bastion. Its terre-plein is elevated from 8 to 12 feet above that of the rampart, having a parapet of 18 feet high. The object of this work is to command ground within cannon shot, and by its elevation to protect the adjacent curtains from being enfiladed. It is sometimes provided with a ditch and revetment, so as to serve as a retrenchment.

**Cavalli Gun**—This was one of the early breeching-loading rifled guns. It was invented by Major Cavalli, of the Sardinian artillery. The gun had only two grooves cut spirally along the bore. The breech-closing apparatus consisted of a wrought-iron case-hardened quoin or wedge, which slipped into a rectangular perforation in a horizontal direction, behind the chamber of the gun, and perpendicular to the axis of the bore.

**Cavalry**—One of the mounted branches of the army, divided into *heavy* and *light* cavalry. The duties of cavalry are very extensive on service, comprising the care of reconnoitring parties, outpost duties, feelers in advance of an army.

General de Brack, remarking particularly on the duties of light cavalry in the field, but of course applicable to cavalry of every description, says:—

"No situation requires so many natural dispositions, such an innate talent for war, as that of an officer of light troops. Those qualities which constitute the man of superiority, intelligence, ability, and personal strength, ought all to unite in him. Continually left to himself, exposed to perpetual fighting, responsible not only for troops he himself commands, but also for the safety of those he may be ordered to protect and cover, the employment of his faculties, both moral and physical, is called for every moment. The profession he follows is a rough one; but his opportunities of distinction occur daily—a splendid compensation, which repays him the more richly for his labours by making him earlier sensible of his value.

"To be a good officer of advance guard, it is not enough merely to be brave and to command well under fire: it is necessary to have brought there the greatest possible number of men and in the best condition to act with effect. The latter part of this indispensable requirement may not be the most brilliant, but it is perhaps of the greatest importance; it is not learnt in quarters, and demands a host of conditions.

"The habit of judging of the health of men and horses; a knowledge of prompt remedies applicable in particular cases; the daily and minute inspection of appointments; understanding the necessary and judicious modes of repairing the same; the providing of all that can be useful to the soldier and his horse, without overloading the latter; the equipment well arranged; regularity of pace on the line of march; good situation for the bivouacs; with constant attention to everything which can contribute to the condition of the horse's ability even to dispense for a time with the farrier; a notion of the method of using the utensils contained in a soldier's case; understanding the occasions favourable to refreshment and repose; the moral acquaintance with men under his command; discipline preserved when the dragoons have no longer before their eyes the dread of guard-room or jail; that foresight which ever watches to prevent useless distress to the horses; personal example offered upon every occasion, and afforded the more readily in proportion as those occasions may be trying or difficult; confidence; unbounded devotion; the power of exciting enthusiasm among his followers: these are capabilities the theories of peace cannot teach; these are what, in addition to courage, military *coup d'œil*, and a ready judgment on the field of battle, form the officer of real distinction."

James, in his 'Military Dictionary,' shows the high estimation in which cavalry was always held in former days, in the following words:—

"The most scientific and the most experienced officers have always held the cavalry in high estimation. The services which have been rendered by this body of men, their innumerable successes, of which so many records are preserved both in ancient and modern history, together with the unanimous approbation of those authors who are considered as masters in the art of war: all these circumstances sufficiently evince that cavalry is not only useful, but indispensably necessary, in war. Marshal Turenne was known to say:—'Avec une bonne cavalerie, on travaille l'armée de son ennemi par détail,' meaning thereby that the desultory and rapid movements of dragoons, if properly managed, are of a nature to destroy the best concerted plans of an adversary, by hanging upon his flanks, driving in his outposts, intercepting his convoys, and by taking advantage of every opening during the heat of engagement. The Austrians had a memorable instance of the latter, when the French General Desaix, at the head of a body of horse, decided the fate of the battle of Marengo. In pursuits, the superiority of the cavalry is unquestionable."

General Clausewitz, in 'La Guerre,' liv. v. p. 25, says that, when cavalry is deficient, "la riche moisson de la victoire ne se coupe plus alors à la faux, mais à la faucille."

"Cavalry," says Colonel Du Vernois, in his 'Studies in Troop Leading,' "must keep up the communication between divisions of the same corps, and, consequently, must be at the disposal of the general commanding the divisions. A grave error is made in massing cavalry in brigades or in divisions. Patrols of three or of four men are sufficient to watch the movements of a small body of the enemy in the neighbourhood, and, from their number, will probably escape notice."

The introduction of arms of precision is stated by some authorities to have considerably affected the value of cavalry, especially of heavy cavalry. The employment of light cavalry, however, has since been more frequent. This was observed in the Franco-Prussian war of 1870, the light cavalry of the Prussians having performed invaluable service in all the duties of that branch of their army. But notwithstanding the opinions held of the diminished value of heavy cavalry, it has played a prominent and, as at Marengo, a decisive part in battle. It is now thought by some to be useless to employ that branch of the service against an artillery carrying missiles 3000 yards, and an infantry armed with breech-loaders. But the Franco-Prussian war of 1870-71 proved that heavy cavalry is still of use. Towards the end of the battle of Wörth, Marshal MacMahon, finding all his positions on the point of being turned, ordered a brigade of cuirassiers to charge the Prussian centre. He ordered a second brigade to charge. Both brigades were completely annihilated. But the attempt permitted the fragments of the French troops to fall back. At Gravelotte, the Germans wished to cross a valley, which was covered by the fire of some French batteries; a charge of German cuirassiers silenced the guns; and though the loss was frightful, the desired movement was effected. These incidents are but exceptions to the rule, that cavalry should never be sent against artillery or columns of infantry not broken by artillery fire.

Cavalry should always be at hand to cover the retreat of a defeated army, by frequent and successive charges, or for pursuit in case of victory. General D'Aurelle de Palladines was unable to reap the benefits of his victory over Von der Tann, at Coulmiers, for want of cavalry.

In the British army cavalry is classed as heavy, medium, and light cavalry. The household cavalry and the regiments of dragoon guards are termed *heavy;* the dragoon and lancer regiments, *medium;* and hussar regiments, *light.* The latter may be placed in the same category as the Prussian Uhlans, and on active service would perform, together with lancers, similar duties.

**Cavalry Depot**—A depot formed, at Canterbury, to which all the depot troops of cavalry regiments abroad are attached. For the rules and regulations pertaining to a cavalry depot, *vide* Queen's Regulations.

**Cavesson**—Nose band of iron, wood, or leather, used for breaking in horses.

**Cells, Military**—Places of solitary confinement in which soldiers are imprisoned by order of the commanding officer. The limit of time of confinement is 168 hours.

**Cementation**—The process pursued in producing steel from pure malleable iron. The operation is carried out in placing the iron in troughs with sulphur, salt, charcoal, brick-dust, &c., and exposing the whole to the action of fire in a cementing furnace.

**Central-fire Cartridge**—This cartridge, which is used with central-fire guns, was introduced into this country under the name of the Pattet cartridge, by Mr. Daw, and is known as Daw's central-fire cartridge. It resembles the Boxer patent cartridge, used with the Snider; the base and mode of ignition are the same, but instead of the pasteboard tube, Colonel (now General) Boxer substitutes one of brass, formed by coiling sheet metal in double folds, and covering it with waterproof paper. An improvement has been made in this cartridge since its first introduction, and a patent was taken out by General Boxer in 1866. The case of the cartridge, as it then appeared, has since been used for the Martini and many other systems of breech-loading rifles with great success. It has further been improved upon by Messrs. Ely Brothers, who have taken out a patent for making it "bottle-necked."

**Central-fire Guns** — Breech-loading guns, principally for sporting purposes. They were introduced some years ago by Mr. Daw, the well known London gunmaker. They are thus described in Greener's 'Modern Breech-loaders :—"The principle is snap-action, with the lines over the trigger-guard; the barrels are disengaged by depressing the lever. This gun has the reputation of being strong and durable; it is usually made with back-action locks.

"The greatest advantage gained by the central-fire principle is the non-escape of gas at the breech; the next is cleanliness; besides, there is no pin-hole in the barrels to let in the wet. This pin-hole is considered a great objection by some, as the pin must fit into the notch in the barrels before the barrels can be closed. In very rapid loading, and during excitement in battue shooting, or when after dangerous game in wild countries, this would, perhaps, cause delay in fitting the cartridge properly. 'Delays are dangerous,' especially when being charged by a bear or tiger. The central-fire plan greatly simplifies loading and unloading. It is often difficult to extract a tight-fitting cartridge from a pin-gun; this is another cause of delay, especially when the gun is foul; besides, the cartridges are not so handy to carry, on account of the projecting pin, as the central-fire." These guns, as Mr. Greener states, have undergone, like all other inventions, great improvements since their first introduction, especially in the striking action.

**Centre of Gravity**, *vide* Gravity.

**Centrifugal Force**—That force which impels the body to recede from such a centre, if it were not prevented by the centripetal force; this force, according to the first law of motion, impels the body to move uniformly in a straight line.

**Centring Machine**—A machine used previous to boring and turning a piece of ordnance, to find the exact centre of the mass of metal. This is done by drilling a conical hole at both ends of the gun, which are the centres upon which the gun is turned.

**Centring of a Shot**—In gunnery, expresses the accurate fitting of a projectile in the bore of a rifled gun, so that when it leaves the gun it will do so with a rotation round its longest axis, having that axis coincident with the line of flight.

B.L.R. guns having leaden-coated projectiles are best centred, as they have no windage, and cannot move in their passage up the bore; whereas M.L.R. guns have windage, and though the shot may be properly centred by means of studs and accuracy of fit and rifling, there is a liability or greater chance from the action of the powder, of the projectile not leaving the piece so well centred. Want of proper centring is very instrumental in producing inaccurate shooting.

Captain Morgan, R.A., in his paper on "Rifling Heavy Guns," 'R. A. Institution Papers,' vol. viii. No. 7, remarks as follows on the subject of accurate shooting:—"This last can only be obtained by proper centring; for if the projectile is not properly centred, there is always an initial cause to interfere with the after regularity of the deflection. There can be no doubt, however, that a rapid twist is the best thing that will compensate for want of centring, because, in the first place, it is not so easy to deflect the point of the shot as it comes out of the gun when the twist is great; and in the second place, any initial deflection which may exist becomes more readily absorbed in the larger and more stable gyration which afterwards ensues. It is better, however, to do with a less rapid twist and more perfect centring, not only because it strains the gun and projectile less, but also because it in reality gives more accurate shooting."

Centring is thus explained in the 'Treatise on Ammunition,' published in 1874:—"The projectile in loading bears on one side of the stud, which is called the 'loading edge;' on firing, it bears against the other side, which is called the 'driving edge;' if the sides of the studs be perpendicular to the projectile, or, to speak more correctly, normal to its surface, and the groove be of a corresponding shape, the stud will remain at the bottom of the groove; but if the side of the stud be made an inclined plane, and the side of the groove corresponding in shape, the stud on being pressed against the groove will have a tendency to run up the inclined plane, and by so doing will centre the shot in the bore, that is, will bring the axis of the shot to correspond with the axis of the gun; the windage will in this case be evenly distributed all round the shot, and the shot will not be in contact with the bore. Hence, with bronze guns centring is desirable, as even with a groove of a depth equal to the height of the stud there would be no contact."

**Centripetal Force**—A force which continually tends to draw or impel a body towards a certain fixed point or centre.

**Chaco**, or **Shako**—The military head-dress used in the British and continental armies when in full-dress.

**Chain Mail**, or **Chain Armour**—A kind of armour much used in the twelfth and thirteenth centuries. It was formed of hammered iron links connected one to another into a dress or form of a garment. Its advantage was in its lightness and flexibility, compared with the sheets of steel or brass of other metal armour, but it was not so good a protection from the spear or lance.

**Chain Shot**—Consists of two hollow hemispheres, joined by a chain, forming one shot when united. When the shot is projected, the two parts separate to the distance limited by the length of the chain, and sweep over considerable space. Chain shot were chiefly used in destroying the rigging of ships. They are now obsolete.

**Chalk,** or **Carbonate of Lime**—A white calcareous substance, prepared by precipitating a solution of chloride of calcium with carbonate of soda and washing; the precipitated chalk of the pharmacopœia is thus formed. Chalk is well known in Europe as an extensive secondary formation. In the arts, it is commonly known as *whiting*, after separating the grosser impurities of the chalk. It is used very generally for artillery purposes in arsenal workshops, for marking the centre and line of metal on ordnance, to mark the position of gun carriages and mortar beds on their platforms, and in a variety of uses.

**Challenge**—In a military sense, "is the warning a sentry gives to any person approaching his post after dark in these words:—*Who comes there?* At the same time he comes to the charge to prevent any sudden rush upon his post. If the reply of the approaching person is satisfactory, the sentry will allow him to pass in these words:—*Pass, friend, all's well.*" A similar challenge is made to any patrol visiting the guards of a garrison or camp during the night, such as the grand or visiting rounds. The term is also applied to the custom formerly of calling another to answer for an offence by combat.

**Challenging**—In a legal sense, and as applied to military matters, "is the right a prisoner has of objecting to the president or any other member of a court-martial. If he objects to the president, his objection, unless disallowed by two-thirds at least of the other members, must be referred for decision to the authority by whom the president was appointed; and the court, if necessary, will adjourn.

"If the prisoner objects to any member other than the president, his objection must be decided by the president and the other members of the court; and when the place of the president or other officer, in respect of whom any challenge shall have been made, and allowed, shall be supplied by some other officer . . . the president and other officers . . . shall take the . . . oath before the judge-advocate."

**Chamade**—A signal made for parley by beat of drum.

**Chamber**—In guns, is a recess formed at the lower extremity of the bore in the direction of the axis, and in S.B. and M.L.R. ordnance of less diameter than the bore, to contain the charge of powder. The chambers of the former are *gomer* shape (a truncated cone), and adopted in all S.B. howitzers and mortars, as they admit of the shot or shell fitting closely into the chamber, thus allowing the full force of the charge, which is small compared to the calibre of the projectile, to act upon it, instead of a portion going past it, as in the cylindrical-shaped chambers. The form of the chamber of M.L.R. guns varies in different patterns of heavy guns, that now used being slightly conical. In B.L.R. guns there are two chambers, one for the powder, the other for the shot; both these chambers are larger than the bore. The shot chamber is coned so as to nip the shot in the proper position, and the shot is shaped to correspond.

**Chamfer**—A small channel or furrow cut in wood, stone, &c. It may be also explained as an edge, or arris, taken off equally on the two sides which form it, leaving what is called a chamfer or a chamfered edge. If the arris be taken off more on one side than the other, it is said to be splayed or bevelled.

**Chamois Leather**—Receives its name from the skin of the chamois goat, from which it was originally made, and which, in being prepared, undergoes a process of oiling. This kind of leather is now made commonly from the skins of deer, goats, and sheep. It is also termed *wash* leather.

**Chape**—The metalline part put on the end of a scabbard, to prevent the point of the sword or bayonet from piercing through it.

**Chapelle de Fer** (French, iron head-dress)—Means an iron hat, and formed anciently every kind of covering for the head. It was the head-piece of soldiery in the reign of William Rufus, and in subsequent reigns.

**Chaplain, Military** — A clergyman whose services are retained by the government for the spiritual welfare of the soldier. Military chaplains are divided into four classes, which include chaplains of other denominations than those of the Church of England. They are appointed by the Secretary of War, and are placed under the Chaplain-General at the War Office.

The chaplains are not attached to individual regiments, but to the staff of the army, and their services are available in peace or war. At home they are attached to military stations or camps, such as Dublin, Aldershot, the Curragh, &c. In India each military station or cantonment has a chaplain attached to it.

**Charcoal**—A form of carbon obtained by burning wood in pits, or by distilling it in iron cylinders. As one of the great uses to which charcoal is put to is in the manufacture of gunpowder, the following description of the mode of charring the wood will not be uninteresting. Charcoal for gunpowder manufactured at the government factory, Waltham Abbey, and private factories in this country, is produced by distillation from the following woods—alder, willow, and dogwood; in India from the *urhur* or *dhal* stalk (*Cytisus cajan*). Previous to charring the wood, the bark is stripped off, and the wood is cut up into small lengths, and placed in sheet-iron cylinders termed "slips," which are placed inside cast-iron retorts, built in the wall of the charcoal furnace, around which the heat circulates; by this means a regulated heat is applied throughout the operation of charring. Each retort, as well as each slip, has two holes in it, for the escape of the gases from the wood, which are conducted by iron pipes into the furnace. The method of obtaining charcoal by distillation renders it easy to char the wood uniformly and at a low temperature. The time taken to carry out the operation of charring occupies about three hours and a half. The slip, which is air-tight, is then removed, and remains unopened from four to six hours, or until all the fire is extinguished; at the expiration of this period the charcoal is taken out, picked, and stored.

The good quality of charcoal is known from its jet-black velvet-like appearance, and there are other indications, such as its being light and sonorous when dropped. It should also be so soft as not to scratch polished copper, and ought not to exhibit any alkali when treated with pure distilled water. Twenty-five per cent. of charcoal is the general yield from all the woods mentioned.

Good charcoal for workshops in India is made from the *sal* tree (*Shorea robusta*), and charred in pits. Charcoal is also made from the *soondree* tree (*Heritiera minor*)—which gives a great heat, and on that account is not so good as that made from *sal*, as in fusing metals it causes the earthen crucibles to run into a vitrified state. Charcoal is used in workshops by braziers for all work in their line, and by armourers for blueing and blacking sundry parts of the iron mountings of rifles, &c.

The following test for charcoal is given in the 'Handbook for Field Service,' 3rd edition:—"(1) Heat fifty grains of the powdered charcoal in an open porcelain crucible; it should not emit any inflammable gas having the smell of burnt wood. Continue the heat until the whole of the charcoal is consumed; the ash which remains should not weigh more than one grain, and should be free from particles of sand. (2) Boil fifty grains of the powdered charcoal with a measured ounce of distilled (or clear rain) water in a porcelain dish, for five minutes; the liquid should not impart a brown tint to a piece of turmeric paper, and should scarcely tinge with blue a piece of reddened litmus paper."

**Charge**—Denotes the weight of powder used in each round of ammunition, whether for ordnance or small-arms. The charge for the several natures of smoothbore cast-iron ordnance is as follows:—For heavy and medium guns about ⅓, and for light guns, ¼ the weight of the shot. But, as Captain Majendie observes in his 'Treatise on Ammunition,' it is impossible to give any invariable rule for the weight of the charge in terms of the weight of the projectile, because of the vast number of reduced and exceptional charges, and because, even in the case of "service" charges, there is, in the majority of instances, more than one of these charges for each nature of gun, according to its weight of metal, or whether it is made of iron or brass.

The service charges for howitzers are:—

For iron, 1⁄12 weight of shell.
For brass, ⅐ to ⅙ weight of shell.

In ricochet firing, these charges are greatly reduced—from $\frac{1}{20}$ to $\frac{1}{30}$ the weight of the shell, but no fixed charges can be laid down; they vary according to circumstances. Charges for mortars are demanded as for the maximum charge for the mortars to be fired. B.L.R. guns have a less charge than smooth-bored ordnance, the Armstrong gun having only $\frac{1}{8}$, and this arises from the gun having no windage; consequently the whole of the elastic fluid acts upon the shot, and none goes past it. There is no general fixed charge for M.L.R. guns, such as is laid down for smooth-bored guns; their charges depend on the weight of the shot or shell used, and vary from $\frac{1}{6}$ to $\frac{1}{10}$ the weight of the shot. What are termed battering and full charges will be found under their respective heads. For the charges of small-arms, *vide* Appendix B.

**Charge**—In military evolutions, this term expresses the advance of a body of infantry or cavalry to the attack of an opposing force.

**Charge**—In military law, as described in Colonel Pipon's 'Manual,' is "the specification of any crime or offence for which a commissioned officer or soldier is tried before a court-martial. The duty of framing the charges against the prisoner devolves upon his commanding officer. They must be specific, and not vague or indefinite, and care must be taken that there is sufficient evidence to sustain them—for preferring accusations which cannot be sustained has been declared to be not only inconvenient and prejudicial to the service, but disgraceful to those who bring them forward.

"All charges may be amended, and additional charges may be brought at any time before the prisoner is arraigned, but not after; and any material variation or omission in the charges may be fatal.

"The prisoner is to be furnished with copy of the charges a reasonable time before trial; and if he cannot read, they are to be read to him."

**Charger**—A name originally given to a war horse accustomed to the clang and noise of battles, and considered consequently reliable in the hour of danger.

In the middle ages a charger was nearly covered with armour, similar to the rider or man-at-arms, and had an iron spike projecting from the middle of the forehead, to aid him in charging. As gunpowder was not then known, the armour of the horse preserved him from the arms in use.

Now-a-days a charger means an officer's parade horse. Each mounted officer has to keep up a certain number of chargers, for which in England he receives forage, or money in lieu, and in India a money allowance; the number of horses he has to provide himself with depends upon his rank and the branch of the service to which he belongs. The average height of chargers is 15½ hands.

**Charger Pits**—Shelter pits to cover the chargers of mounted officers when exposed to the enemy's fire. They may be excavated parallel to and 20 paces in rear of lines of shelter trenches.

**Chase**—In artillery, one of the four named parts a S.B. gun is divided into; it is comprised between the front of the second reinforce ring and the muzzle astragal and fillets; or, perhaps, to put it in more comprehensive terms, the greater portion of the gun between the muzzle and the trunnion. The term is applicable to rifled guns as well.

**Chassepôt Rifle**—A breech-loading needle-gun. In its original form it was the small-arm of the French service, and in its modified form is still so. This rifle is the invention of Monsieur A. Chassepôt, the chief viewer of the central depot, Paris.

A detailed description of this weapon would need illustrations to make the mechanism of the lock and breech-piece clear to the reader: it is only intended, therefore, to give a general idea of the arm. "When first adopted in the French army, it was not unlike the original Prussian needle-gun, and was apparently a modification of it, but was said to be superior to it in the closing of the breech, whereas the Prussian rifle was defective in this point. The original Chassepôt rifle was 4 feet 3 inches in length, and weighed a little less than 9 pounds; it had four grooves, with one turn in 21½ inches. The accuracy of the rifle is said to have been very great at 600 yards, and could fire from 6 to 8 shots per minute. The objection originally stated against the Chassepôt was that, after much firing, it became so hot as to be inconvenient to handle.

"The cartridge, which is made of silk, contains a larger charge of powder than the Prussian cartridge of the original needle-gun, with a smaller bullet, which is an advantage in favour of the French weapon as compared with the Prussian, in the number of rounds to be carried. The total weight of the cartridge, bullet included, is ·0716 lb., the bullet being ·0529 lb. The length of the cartridge is 2·67 inches."

From observations made during the war between France and Prussia, it appears that the "assumed superiority of the Chassepôt over the Prussian needle-gun in actual warfare was greatly overrated, and what were supposed to be the advantages of the arm proved, in the day of battle, a source of anxiety and danger to the soldier. Its lightness, with its large charge, had the effect of causing great recoil and of heating the barrel. The superior range attributed to it induced the men to fire away rapidly on commencing an action, and at such long distances that, before closing with the enemy, the barrel had become so heated that it was no longer serviceable. Further, from the recoil and heating of the barrel, the soldier was obliged to fire from his hip instead of his shoulder, which caused great inaccuracy of aim; worse still, after much firing, the breech arrangement clogged, and the arm was useless. The cartridge, as in the Prussian needle-gun, does not clear the barrel out each time it is fired, but leaves behind it a thick, fatty, black substance which clogs the breech and renders the piece unserviceable."

Doubtless the result of all these faults in the arm of the French service had a deterring effect in the war with Prussia, for it is further stated that the French soldiers had found, after a certain time, that it was impossible to load their pieces, and had in numerous instances thrown away their ammunition. In the modified Chassepôt, all that was defective has now been remedied.

**Chasseurs**—French light troops, infantry and cavalry.

**Chasseurs à cheval**, or **Chasseurs de France**—Light cavalry of the French army. They are armed with the Chassepôt carbine and with swords. There are twenty regiments.

**Chasseurs à pied**, or **Chasseurs de Vincennes**—Light infantry of the French army. In the new organisation of the French army, there are thirty battalions of infantry chasseurs.

**Chasseurs d'Afrique**—Four regiments of cavalry, mounted on Arab horses, and raised for the purpose of warfare in Algeria. They took part, however, in the Franco-Prussian war of 1870–71, and also in the Crimea, where one of the regiments, the "Fourth," distinguished itself by supporting the charge of the light cavalry at Balaklava.

**Chaufron** — Masked armour which covered the face, the head, and the ears of military horses during the middle ages, to prevent the horses taking fright when charging the enemy.

**Cheeks**—The sides of a gun carriage in which the trunnions of the gun sit. The term "cheeks" is also applied in fortification to the interior facing of an embrasure.

**Chelsea College** or **Hospital**—An edifice built on the banks of the Thames, which was originally begun by James I., and intended as a college for a certain number of learned divines. The unfinished buildings were afterwards completed, and finally converted by Charles II. into an hospital for non-commissioned officers and privates who were wounded or maimed in the service, and has remained to the present day a refuge for our worn-out or wounded soldiers, who are termed "In-Pensioners."

**Chemin de Rondes**—In fortification, a berm from 4 to 12 feet broad, at the foot of the exterior slope of the parapet. It is sometimes protected by a quickset hedge (in India a cactus hedge), but in more modern works by a low wall, built on the top of the revetment, through which (the wall being loop-holed) and over which the defenders can fire and throw hand-grenades into the ditch.

**Chesses, Pontoon**—The planking or

flooring boards of a pontoon bridge. In cylindrical pontoons, the boards are fastened to the baulks by means of cleats, but in the present pattern pontoons without cleats. Each chess consists of three planks. Half-chesses, consisting of a single plank, are used for that part of the floor which is immediately over the saddle of the pontoon.

**Cheval**—A body of troops is said to be "à cheval" on a road, when it stretches perpendicularly across it.

**Chests, Arm**—Are wooden boxes for holding the rifles or carbines of soldiers on board ship, or elsewhere. Each Martini-Henry chest contains twenty rifles.

**Chevaux de frise**—A kind of defence or obstacle used in fortification. They are made in lengths of from 6 to 10 feet, joined together, when necessary, by chains. Each length is composed of a barrel or stout beam, from 6 to 12 inches in diameter or square, with strong sharp spears driven through it, in two or more different directions, up to their middle, so as to radiate from it like wheel spokes. The present pattern chevaux de frise is made of iron, barrel, cylindrical: the whole consisting of tubes, the spears (twelve in number) being plugged at the ends with points; and packed away inside the barrel. Each length weighs 86 lbs. The iron pattern has the advantage of greater portability in reference to bulk. The position of a chevaux de frise is sometimes at the foot of the counterscarp, or upon the berm. In the latter position a glacis is necessary to cover them from the view and fire of an enemy.

**Chevron**—The distinguishing marks on the sleeves of non-commissioned officers. They are worn on the right arm by cavalry and infantry, and on both arms by artillery, engineers, fusiliers, and light infantry regiments, in the following order:—

| | |
|---|---|
| Sergeant-majors .. | 4 bars. |
| Sergeants .. .. | 3 „ |
| Corporals .. | 2 „ |
| Bombardiers .. .. | 1 bar. |
| Second corporals .. | |
| Lance ditto .. .. | |
| Acting bombardiers .. | |

Sergeant-majors and quarter-master sergeants wear their chevrons below the elbow, point down. Non-commissioned officers of artillery wear their chevrons above the elbow, point down.

**Chief of the Staff**—An officer who ranks next to the general under whose orders he is serving, and is appointed to relieve the commander-in-chief of an army of an immense amount of detail work, and to harmonise the action of the several departments. Such an officer is appointed in foreign armies. The question was raised, so far back as 1812, in this country, whether a chief of the staff should be added to the staff of the commander-in-chief. During the Crimean War, and subsequently in India during the Mutiny, an officer of this rank was appointed.

**Chilled Shot**—Shot formed by pouring liquid grey cast iron into a cold metallic mould, so as to cause the most sudden cooling possible. By this process, which was introduced by Major Palliser, the surface of the shot is rendered extremely hard, and capable of penetrating iron-plated ships. It has been found only necessary to chill the head of the shot, and to let the body be cast in sand.

**Chime**, or **Chimb**—The end of a tub or barrel. All powder-barrels are ordered to be rolled on the chime as being the safest mode of moving powder either in magazines or mill-houses.

**Chlorate of Potash** ($KO.ClO_5$)—A salt prepared by passing chlorine slowly through a solution of carbonate of potassa. It is a colourless, transparent, anhydrous, crystalline salt. It has great oxidising powers, and when brought into contact with other substances, such as sulphide of antimony, becomes highly explosive. An attempt to manufacture gunpowder from it has been made, but in the act of mixing it with charcoal and sulphur, it was found to explode, and the attempt had to be abandoned. It is one of the ingredients in the detonating composition of friction tubes and gun-caps, and though not used in the ordinary burning compositions, it will be found in the ingredients of coloured lights.

**Chloride of Barium** ($BaCl \times 2Aq$)—One of the preparations of the metal barium. It is prepared by adding hydrochloric acid to a solution of the sulphuret of barium, when hydrosulphuric acid escapes and chloride of barium remains behind, and on evaporation forms crystals. It is used chiefly as a re-agent for the purpose of testing for acids, especially sulphuric, with which it forms the insoluble sulphate of baryta. In testing saltpetre, this re-agent is used in searching for sulphates.

**Chloride of Potassium** (KCl)—This salt occurs in sea water, and in the water of many mineral springs. It is obtained as a by-product in various processes, particularly in the manufacture of soap and glass, and in the refining of nitre. In the latter case, a solution of nitrate of silver is used to detect the chloride, the presence of which is observed first by a milkiness, and on a larger quantity of solution being added, a curdy precipitate of chloride of silver.

**Chock**—A wedge or coin attached to cast-iron garrison carriages on which the breech of the gun rests and is elevated. Chocks are of different natures, and are used for different purposes, and have different names.

**Chocks, Friction**—Breaks attached to the common standing garrison carriages of S.B. guns, so as to raise the trucks or wheels off the platform when the gun begins to recoil, to prevent its running back to any great extent.

**Chocking**, *vide* Slewing.

**Choker, Fascine**—An instrument used for bringing the ends of a fascine to the girth, nearly where it is intended the fascine should be, when the fascine is then bound.

**Chord**—In geometry, signifies a line which joins the extremities of any arc of a circle.

**Chronograph, Bashforth's**—An instrument adapted for measuring the varying velocity of a body in motion through the air, and for other ballistic purposes. It has been successfully employed in determining the resistance of the air to the motion of spherical and elongated projectiles, varying from 3 to 9 inches in diameter; and a simple instrument has been constructed on the same principle for use in those cases where the determination of the velocity of a shot at a given point is all that is required. (*Vide* Gunnery.)

**Chronoscope**—An instrument for determining the initial velocity of projectiles. Among the many instruments of this nature, the one invented by Navez-Leurs is an improvement or modification of the well-known Navez's electro-ballistic apparatus. The chief modification consists in the suppression of the conjunctor and the large electro-magnet, which serve to clamp the needle.

Another chronoscope has been invented by Captain A. Noble, F.R.S., late R.A., for the determination of the time a projectile takes to traverse various intervals within the bore of a gun. This beautiful instrument is able to register, by means of electric currents, upon a recording surface, travelling at a uniform and very high speed, the precise instant at which a shot passes certain defined points in the bore.

**Chuck**—That part of a turning lathe which is screwed on to the nose of the mandrel in which the work is held or supported, and caused to revolve with the mandrel. Its forms are numerous.

**Chuckler**—An Indian term, signifying a cobbler, or worker in leather. This class of men is employed in all government establishments in India where leather work is made up.

**Chuttack**—An Indian weight, the sixteenth part of a seer.

**Circle**—A plane figure, contained by one line which is called the circumference, and is such that all straight lines drawn from a certain point within the figure to the circumference are equal to one another. This point is called the centre of the circle.

**Circumference**, *vide* Circle.

**Circumferenta**—A small hand wheel, which is used to measure the circumference of the outside of the felloes and the inside of the tire of a wheel. It is made of sheet-iron, about 8 inches in diameter, with the circumference serrated to prevent it from slipping. A line is scratched on the face to serve as an index.

**Circumvallation** — In fortification, works constructed round a besieged place to cut off all communication between the besieged and the surrounding country.

**Citadel** (Italian *citadillo*, a little city)—A stronghold within a fortified place which overlooks the country. It answers a double purpose: first, it enables the garrison to keep the inhabitants in subjection; secondly, in case of a siege, it forms a place of retreat when the enemy has got possession of the main portion of the works. It is not applicable to modern fortifications.

**Civil Departments**—Are branches of the British army under the War Office. They include:—

(1) Control Department,
(2) Medical „
(3) Veterinary „
(4) Chaplain's „
(5) Education „
(6) Administration of justice.

**Clamp, To**—To fix the movable parts of an instrument by pressure applied to a screw; for example, the vernier, or horizontal and vertical plates of a theodolite, are said, when fixed, to be *clamped.*

**Claw, Hammer**—Two prongs placed at the end of a hammer or crowbar, for drawing nails and spikes which require force for their extraction.

**Claymore, or Cly-more**—A large double-edged blade, formerly in use among the Highlanders, and now used by officers and non-commissioned officers of Highland regiments. It appears that the term claymore is derived from the Gaelic for "the great sword."

**Clearance**—A term given to the space or interval between the body of the shot and the bore of the gun. It is thus explained in the 'Treatise on Ammunition for 1874:'—"If the depth of the groove is less than the projection of the stud beyond the body of the shot, there will be 'clearance,' that is, there will be an interval between the body of the shot and the bore of the gun, and consequently the shot will rest entirely on the studs; the amount of clearance will be the difference between the depth of groove and the projection of the stud. Thus in some Woolwich guns the depth of groove is ·18 inch, the projection of stud is ·195 inch, therefore there is a clearance of ·015 inch. This is the mean clearance, and is liable to be reduced by manufacturing limits. With iron guns it is not generally considered of much importance to have clearance, but where bronze is used, it becomes essential, as the iron projectile would injure the softer metal of the gun."

**Cleats**—Small blocks of wood used commonly for securing movable articles which are likely, as at sea, to roll over or be displaced. In the artillery service they are used in different parts of gun carriages for fixing tools, &c.

**Clinometer**—An instrument to ascertain the exact distance of any particular object; it is valuable in elevated coast batteries. The clinometer invented by Captain J. R. Oliver, R.A., for laying guns obviates the necessity of a reference to range tables, length of fuze, &c., as all is detailed on the instrument for the nature of gun.

**Clip**—An instrument for lifting heavy shells, and is used with M.L.R. guns from the 7-inch to the 12-inch.

**Clipper, Portfire**—The name formerly given to the cutting implement which was fixed on the off side of the beam trail of a gun carriage, for cutting off the lighted end of the portfire. Portfires being no longer in use, except on emergency, and having been superseded by friction tubes, the sockets and cutters have been removed from all artillery carriages.

**Cloth**—Any kind of manufacture or stuff formed by weaving or intertexture. In arsenals, this material is much used, and is of various kinds—viz. book muslin, buntin, canvas, doosootie (an Indian name), serge, vitry, waxed cloth, and silk. The cloths enumerated are made use of for the following purposes:—Book muslin, for the bottom of sieves, &c.; buntin, for colours; canvas, as shown under that head; doosootie, for capping carcasses, and it is also occasionally used for package and in making blowing bags; serge, for service cartridge bags; vitry, which is a fine kind of canvas, for making paulins and powder cloths, occasionally for 13-inch blowing bags, sponge caps, and gun aprons, also for saddle wrappers; waxed cloth, for powder barrels (1¾ yard being required to pack a powder barrel in), and for wrapping round elevating screws, fuzes, &c.; silk, for exercising and saluting cartridges, though the use of this material is likely to be extended to service cartridges.

**Clothing, Military**—The dress worn by the soldier, which is provided for him gratis by the state, and which is made up at the Government Clothing Establishment, Pimlico. All routine correspondence as to size, rolls, indents, &c., is carried on direct by regiments with Pimlico, but objections and reports on fresh articles are sent to the Adjutant-General. Clothing condemned by regimental boards is reported to the Adjutant-General. The general officer in command either inspects the clothing himself, or orders a garrison board. The cost of clothing for the soldier varies from 2*l.* 6*s.* for a private in the line to 8*l.* 15*s.* for a life-guardsman. All uniforms as stated are now issued to the soldier without charge against him; he has only to pay for the renewal of necessaries.

**Clove Hitch**—Termed also the *cascable hitch;* is a well-known knot in the artillery service: it is used in mounting and dismounting guns, capping fuzes, tying cartridges, &c.

**Club, To**—In military evolutions, to throw troops into confusion, to deform through ignorance or inadvertency. To club a battalion implies a temporary inability in the commanding officer to restore any given body of men to their natural front in line or column.

**Coal**—A mineral of vegetable origin. It is thus described by Sir C. Lyell:—"When wood and vegetable matter are buried in the earth, exposed to moisture, and partially or entirely excluded from the air, they decompose slowly, and evolve carbonic acid gas, thus parting with a portion of their original oxygen. By this means they become gradually converted into lignite or wood coal, which contains a larger portion of hydrogen than wood does. A continuation of decomposition changes this lignite into common or bituminous coal, chiefly by the discharge of carburetted hydrogen." The coal chiefly used on the Bengal side of India for steam-engines in the government arsenals and factories, is obtained from the Raneegunge and Beerbhoom mines, about 120 miles from Calcutta. Smithy coal, which is used for all cast-iron work, is imported from England. Anthracite coal is also brought from England, and is used chiefly in the government powder works, alone, or mixed with steam coal. It produces no smoke, and therefore may be used with safety in a powder factory; besides, it contains a greater quantity of carbon than any other coal.

**Coast Batteries**—Batteries erected along a coast to protect the entrances of harbours and ports. They are armed with artillery of the largest calibre to oppose the landing of an enemy.

The nature of ordnance for coast defences was in 1860 recommended to be as follows:—

The 10-inch gun of 86 cwt.
„ 68-pr. „ of 95 „
„ 8-inch „ of 65 „
„ 32-pr. „ of 56 „
„ 13-inch sea service mortar.

Since the introduction of rifled artillery and armour-plated ships, the old S.B. guns, which, formerly, were used for coast defence, have been superseded by the heavier rifled ordnance of the present day.

**Coast Brigade of Artillery**—This brigade was formerly composed of the garrison companies of artillery in the fortified towns of England, under the name of garrison artillery, but in 1771, as is shown in Captain Duncan's 'History of the Royal Artillery,' long after the formation of the royal artillery, these companies were incorporated into the invalid companies of the regiment, and are now represented by what is termed the Coast Brigade. Officers of this brigade are relieved from all garrison and regimental duties, except such as relate solely to the men of the divisions under their command. The coast brigade, as stated in the Queen's Regulations, should only be paraded with other troops in cases of urgent necessity.

**Coat-of-mail**—Armour made of scales or iron rings, linked one within another, and worn in the middle ages.

**Coating**—The covering of any material with paint, lacquer, &c.; it is applied to ordnance as well as to shot and shell, internally and externally. It has been found that coating the interior of shells with black lacquer tends to premature explosions of the shell when fired. Red lacquer is said to make a safer coating. For the coating of ordnance, *vide* ‘Artillerist's Manual,’ or ‘Treatise on Ammunition, 1874.’

**Cockade**—A military and naval badge, or mark of distinction. It consisted of a ribbon worn in an officer's hat to loop it up with. In the armies of Europe, this mark succeeded the scarf which was worn by officers and soldiers, but being found to be attended with inconvenience, it was to a great extent discarded. In the army and navy of Great Britain, the officers were distinguished by black silk ribbon, and the non-commissioned officers, privates, and marines, by hair cockades. This fashion has, for some years past, fallen into disuse, and the cockade is now worn by a military or naval officer's servant.

The following is from Cupan's ‘Handbook of Heraldry:’—“Cockades affixed to the hats of servants constitute an important part of liveries; their use, however, is not in any manner regulated by heraldic laws. They were originally but the knots of the ribbon with which military men used to cock their broad-brimmed hats, and served the purpose of the button or star which ostensibly keeps up the flap of the modern cocket hat. The black cockade as now worn is of German origin, and was not introduced into England before the time of George I.”

**Code, Military**—A collection of rules and regulations, which are sanctioned by authority, for the better government of the army—such as the Articles of War.

**Coehorn Mortars**—Light mortars of 5½-inch and 4⅖-inch calibre, having cylindrical chambers. The 5½-inch mortars of this nature are obsolete in the British service. They were introduced by the great Dutch engineer of that name.

**Cogs**—In machinery, the teeth raised on the surfaces of wheels.

“The term *teeth* is usually applied to cogs on the surface of the large wheel, and *leaves* to those on the surface of the small wheel in contact with it, usually called a *pinion*. The number of times the pinion revolves while the wheel makes one revolution will be evidently equal to the number of teeth in the wheel divided by the number of leaves in the pinion. Let T = number of teeth in the wheel, $t$ = number of leaves in the pinion, and N = number of revolutions made by the pinion while the wheel makes one; or if R, $r$ be the respective radii of the wheel and pinion, then—

$$N = \frac{T}{t} = \frac{R}{r}.\text{”}$$

**Cohesion**—The power of transmitting heat or electricity, without change in the relative position of the particles of the conducting body.

**Cohort**—The tenth part of a Roman legion. A legion generally consisted of ten cohorts of 60 men each.

**Coil**—Applied to the form rope is wound in and issued from the manufactory. A coil of rope, as received into arsenals, contains 120 fathoms.

**Coil of a Gun**—Made by winding a hot bar of iron round a mandrel, which is afterwards removed. The rough coil so formed is then welded, bored and turned to the required size. In building up a gun after Sir W. Armstrong's system, a succession of wrought-iron coils are shrunk on to a tube or barrel of steel; to him is due the credit of being the inventor of this system. But since his original plan of thus building up a gun, an important modification of it has been made by Mr. Fraser, attached to the Gun Factory, Woolwich, who, by using a few long double or triple coils, instead of several short single ones and a forged breech-piece, which is Sir W. Armstrong's system, has effected an immense saving in time and expense.

**Coir**—The fibre of the cocoanut. Very excellent rope for naval purposes is made from it, and is valued, on account of its lightness, elasticity, and strength. Coir cable is prepared in Ceylon, on the Malabar coast, in the Maldive and Laccadive Islands, and in most places along the eastern and western coasts of the Bay of Bengal, where cocoanut trees grow. Sponges for guns have been made from the fibre, but they are not equal to sponges made of wool for this purpose, and are, moreover, liable to take fire.

**Coke**—Fossil coal deprived of its extraneous volatile matter by fire. It is sometimes used in combination with coal, where a greater degree of heat is required than coal alone affords. In furnaces for melting pig-iron, kentledge, and other metals, it is the fuel chiefly used.

**Colback**—A busby, or hussar cap.

**Colic**—A complaint with which horses are not unfrequently attacked, caused by indigestion, constipation, spasm, strangury. The remedy for this complaint is thus explained. "The attack will generally yield to the first or second dose of the usual colic mixture, with injections of warm soap-and-water, and with a little spirits of turpentine in it; friction being used to the surface of the belly. If there is constipation, give a dose of the prescribed mixture, with a teaspoonful of ginger in it; if the pain continues and becomes more constant, bleed, taking from six to ten quarts of blood, continue the injections, and give a dram of opium every hour, blister the belly, clipping the hair off first. The cure for colic is powdered opium, 1 dr.; ginger, powdered, 2 drs.; allspice, powdered, 3 drs.; caraway seeds, powdered, 4 drs.; made into a bolus."

**Coldstream Guards**—This regiment forms one of the Household Brigade, and is the oldest regiment in the British army, except the 1st Foot. The name originally of this corps was "Monk's Regiment," from General Monk having raised it in 1660 at Coldstream, but when parliament consented to give a brigade of guards to Charles II., this corps, under the name of Coldstream Guards, was included in it.

**Collar, Horse**—That part of the harness which encircles the horse's neck, and to which the hames are attached, and by means of which the draught is applied to the animal.

**Collar Makers**—Artificers appointed for the repair of draught harness. In the artillery, on first appointment, they have the rank and clothing of bombardiers, and reckon service, as such, without increase of pay. After five years' service, if a bombardier, they have the rank and clothing of corporals, and reckon service for pension, as such, without increase of pay. The four senior collar makers of each brigade are allowed the rank and clothing of a sergeant, but without increase of pay.

**College**—In the common acceptation of the term, is a community of students assembled togêther for instruction; if the instruction be of a military nature, it is termed a military college. The community is bound together by rules and regulations common to all. Such is the college at Sandhurst, and all other colleges.

**Collimator**—An instrument for laying guns and mortars, and especially adapted for laying them for night-firing. But the same appliance as is used by night could be made available by day, with the embrasures closed, thus protecting the gunners from the fire of the enemy. For a description and use of the collimator now in use in the service, *vide* 'Manual of Artillery Exercises,' 1873.

**Colonel**—The highest rank in the army below that of general. After serving five years as a regimental lieutenant-colonel, an officer is gazetted to the rank of colonel in the army, provided he has not received the rank previously by brevet. Colonels, as shown in the Queen's Regulations, continue to perform the ordinary duties of field officers for five years from the date of their commission as colonel, after which period they are not to be included in the field officer roster, but will have special duties assigned to them.

**Colonel of a Regiment**—A general officer placed at the head of a regiment, as a reward for long and meritorious services. He does not command the regiment in person, the command being honorary only, but appears in the 'Army List' at the head of his regiment. As colonel of a regiment, he draws "colonel's allowance."

**Colonel, Brevet**—An officer holding a colonel's commission. An officer of this rank is generally a regimental lieutenant-colonel, and has command of his regiment, which he exercises for a period of five years or upwards, provided he has not attained the rank of major-general.

In the artillery, regimental colonels command districts of artillery, and the senior lieutenant-colonel of a brigade commands the brigade.

**Colonel's Allowance,** *vide* Off-reckonings.

**Colonel-Commandant**—The chief of a brigade of artillery, engineers, or marines. This position is analogous to that of a colonel of a regiment, who receives what is termed the "colonel's allowance." In the early days of this rank in the artillery, Captain Duncan, in his 'History of the Royal Artillery,' states that "the connection of the colonels-commandant with their battalions remained of the closest description. No officer was allowed to be promoted, under the rank of field officer, without a recommendation from the colonel-commandant of the battalion in which he might be serving. Nor was any exchange allowed without the consent of both the colonels-commandant concerned." Even now-a-days, before an adjutant is appointed to a brigade of artillery, the colonel-commandant has to be consulted, and nominates the officer subject to the approval of the commander-in-chief.

**Colonial Corps**—Certain regiments formerly raised or organised in the several British colonies; many of them have now been disbanded. They were formed generally of men (natives) belonging to the colony, paid out of the imperial revenues, and included in the regular army of the British Empire. Such at present are the West India regiments, and the Malta fencible artillery.

**Colour Party**—The two officers who carry the colours of a regiment, as a rule, the two junior lieutenants; four sergeants are also told off to assist, of whom one stands between the two officers and three form a rear rank.

**Colour, Saluting**—An ordinary camp colour, distinguished by a transverse red cross; or when the facings are red, by a transverse blue cross.

**Colour Sergeant**—A sergeant appointed to each company of infantry. He is known by the badge of crossed swords and crossed flags, which he wears above his chevrons. His duties are thus explained in Major Knollys's 'Dictionary of Military Terms':—"He is responsible to the captain for the interior economy of the company, and receives extra pay for the performance of his duties. He also at times performs the duties of a pay sergeant. He is further one of the sergeants told off for the colour party when the battalion is about going into action. In cases of misconduct he is liable to revert to the rank and pay of a sergeant, at the discretion of his commanding officer."

**Colours, Camp**—For marking out the lines of a camp. They are 18 inches square, and of the colour of the facing of the regiment, with the number of the regiment upon them.

**Colours, Military**—Military ensigns carried by regiments of infantry, which are looked upon as rallying-points in the hour of danger. There are two colours carried by each regiment, with the exception of rifle corps: the *royal* or first colour, and the *regimental* or second colour; on the former are the badges and number of the regiment; on the latter—the colour of which is to be that of the facings of the regiment—the devices, distinctions, and mottoes which have been conferred by royal authority, and also the number of the regiment; the whole ensigned with the imperial crown. The 74th Highlanders carry three colours. Crowned heads, princes, and marshals are alone entitled to be saluted by lowered colours. The colours of a regiment are always saluted by guards. The banners of a dragoon regiment are called *guidons*, and those of other cavalry regiments, *standards*. When the colours of a regiment either from service or age are worn out, it is customary for the colonel's wife to replace them, the old ones being deposited in some church or cathedral.

**Column**—In military evolution, the formation of troops, whether in brigades, regiments, battalions, or of companies, in deep files and narrow front, so disposed as to move in regular succession. According to the density of the column, it is called open or close. When companies one behind the other are at such distance as to enable them to wheel into line, the regiment or battalion is then said to be in *open* column; but when the companies are only a few yards in rear of each other, this is termed a *close* column. In artillery, the column formation is in sub-divisions, divisions, and half-batteries. The object of this formation is to reduce the line of frontage of troops, and to give facility in manœuvring. The general formation in the Prussian and French armies is that of company column, superseding the battalion column. On tactical grounds, the company column formation appears to favour the manœuvres of troops, and will doubtless in the future be the formation which all armies will assume. Sometimes the name *column* is given to a body of troops which is in effect a small army.

**Column of March**—A formation assumed by troops on the line of march, which is governed partly by tactical considerations, partly by arrangements for supply, &c. This formation consists first of an advanced guard, which is purely *tactical.* At the head of the column, or with the advanced guard, come the sappers, to clear the roads, to repair bridges, and generally to facilitate the march of the column.

Next comes the first brigade of infantry, having its intrenching tools, for throwing up covering works, if necessary. Its ambulance wagons are kept in the rear, or should do so, and not be allowed to be under fire. All transport of sick from the field of battle should be carried out by stretchers.

The position of artillery with such a force should be regulated by tactical considerations. If not required, it should be in rear of the infantry, but, if wanted, should be in rear of the first battalion, or first brigade, sometimes between brigades. Artillery, if between infantry, must conform *exactly* to the pace of infantry, which is very fatiguing and trying to the horses; if in rear, they can make longer halts and vary pace. Mounted corps, when practicable, should march at later hours than dismounted men; if the column comes unexpectedly on the enemy, it is easier to trot artillery past infantry than to hurry up infantry past artillery. The same principles which are applied to artillery may be also to cavalry, and such of it as is not with the advanced guard is generally in rear of all the force.

It is desirable, if not imperative, that artillery and cavalry should not have to conform to infantry pace. It is stated that the French cavalry in 1859 suffered severely from this. The position of the staff of a division is at the head of its own column, that of brigades at the heads of their brigades, but they should from time to time ride back to the rear to see that their column maintains order. Mounted police are usually with the train. The following gives the order of the train:—

"1. Reserve ammunition column.

"2. Ambulance and field hospital.

"3. Provision wagons, and cattle required for the day's supply.

"4. Regimental and staff baggage.

"5. Control—provision columns and baking trains."

The above may be taken as the real order of march in the vicinity of an enemy, and should be adopted unless otherwise ordered.

For larger bodies of men than is here contemplated, other arrangements will be made, as shown in 'The Soldier's Pocket Book.'

**Combat**—A battle or duel. Anciently it was not uncommon for contending powers to settle their dispute by single combat, when each party chose for itself a champion who contested the point at issue in the presence of both armies.

**Combustion**—A term familiar in the laboratory. It is applied to the process of burning, which is caused by the addition of oxygen of the air to the constituents of the combustible substance, or in one of the constituents possessing such an excess of oxygen to the other ingredients that on fire being applied it takes fire at once, as in the case of gunpowder.

**Command**—In fortification, when several works cover the same ground, the difference of level, when one work is higher than another, is called the *command* of that work over the other. When this difference of level is sufficient to allow of both works to fire at the same time upon an enemy's advance, one over the other, it is termed a *command of fire.* But when the difference of level is only sufficient for the inner work to look into, and act upon the interior of the outer one, it is called a *command of observation.*

**Commandant**—A title given to officers at the head of certain government establishments, which have for their object the education or training of officers and soldiers for or in the army. The term is also applied to the commander of a garrison or town, fort or fortified post, and to the chief-in-command of a brigade of artillery, engineers, or marines.

**Command, Military**—The authority in chief exercised by the senior officer of a regiment or of any body of troops. To this position there is a certain "command pay" attached, in addition to the regimental pay, varying according to the nature of command. In the British army, when quartered at home, the command allowance is very small, but in India officers commanding regiments are very well remunerated.

**Commander**—An officer having superior authority over others.

**Commander-in-Chief**—This title has not been assumed by the officer administering the command and affairs of the army since the death of the Duke of Wellington. The powers alluded to have been invested in an officer holding no higher commission than that of "General on the Staff;" who is called the general (or field marshal, according to the army rank of the holder) commanding-in-chief. He acts in conjunction with the Secretary of War. His office, technically termed the "Horse Guards," supervises the recruiting, training, discipline, distribution of appointments, and command of the army.

The officer commanding all the troops in India is styled Commander-in-Chief, and the same title is given to the officer commanding the troops in each of the subordinate presidencies. The Queen, being the head of the army, appoints the several commanders-in-chief of the British and Indian armies.

**Commander-in-Chief's Department**—A department of the army which consists of the Adjutant-General and Quartermaster-General, nominally amalgamated, but working apart. The following branches, at the Horse Guards, are called divisions, and are thus told off:—

Military Secretary.
Intelligence.
Auxiliary forces.
Military education.

**Adjutant-General** and **Quartermaster-General** are ordinary combatants, to whom are entrusted respectively the departments of—

| | |
|---|---|
| Adjutant-General .. | Recruiting.<br>Discharges.<br>Discipline.<br>Inspections. |
| Quartermaster-General | Returns.<br>Movement of troops.<br>Intelligence. |

To the Military Secretary's Department is entrusted—

First appointments.
Promotion.
Rewards.
Staff appointments.
Exchanges.

The above is the distribution of the staff at the Horse Guards, and these divisions are adhered to in the smaller fractions as closely as possible.

**Commissariat**—Formerly a special branch of the army, now called the Supply Branch of the Control Department; upon it devolved the responsibility of collecting all provisions, forage, &c., necessary for troops in cantonments, or in the field. (*Vide* Control Department.)

In war time, the feeding of the troops is the most difficult of all operations, and necessitates the best exertions of the most experienced officers in the department to insure an army being fed. In consequence of the difficulty alluded to, the First Crusade never got beyond Hungary. A reference to the reports of Wellington and Napier during the Peninsular campaign, and, latterly, to those of the Abyssinian Expedition, will show the difficulty on a campaign in an enemy's country, in the first place of securing food, and in the second of carrying it.

The Ashantee War is a recent instance of the difficulty of conveying food, when from the cowardice of the Fantees, and the dread they had of the Ashantees, they refused to carry the food and baggage of the army, which had to be carried by the West India regiments.

Then again, when we consider how dependent the British soldier is on the nature of his food, more so than the soldiers of other nations, and that military operations are sometimes carried on in countries offering no resources, the duties of the Commissariat or Supply Department are burthensome, and stupendous in the extreme, and it should be therefore treated by the army with great patience and consideration.

**Commissary**—This term was used in the old French service to express a variety of military occupations, as it is in the Control Department of the British service at the present day.

**Commissary of Ordnance**—The departmental title given to an officer of artillery who has charge of an arsenal in India. Each officer, on being appointed to the Ordnance Department, remains on probation until he has passed an examination in the various subjects appertaining to the charge of an arsenal, such as accounts, the nomenclature and use of stores, the working of metals, &c., when, if found qualified, he is posted to the department. The duties attached to the office of a commissary of ordnance will be found in the ordnance codes of each presidency.

**Commission**—In a military sense, is the warrant signed by or on behalf of the sovereign, authorising an officer to exercise command in the army.

Commissions, commencing with the sub-lieutenants of the army, are given to candidates after passing the prescribed examination before the Civil Service Examiners, when they are sent to Sandhurst College, for further instruction, chiefly of a military nature. They are not posted to regiments until they have passed the final examination, except those who are gazetted to regiments in India which they proceed at once to join. After serving one year with their regiments, they are attached to garrison classes in India, and undergo a course of military instruction required to qualify them for promotion to the rank of lieutenant.

Militia lieutenants are eligible for commissions in the regular army after serving for two trainings in a militia regiment; on passing the usual examination they are further subjected to such regulations as to age or otherwise as may *be issued from* time to time by the Secre*tary of State for War*.

A commission of lieutenant in the cavalry or infantry of the line can also be obtained by officers of the Royal Malta Fencible Artillery on passing the prescribed examination, similar to that which is required of a sub-lieutenant in the army. According to the orders of the Secretary of State for War, only two commissions in every three years will be granted.

Cadets who are educated at Woolwich receive their commissions either in the artillery or engineers on their leaving the academy.

As purchase is now abolished in the army, promotion to the higher ranks is given by merit or selection. Commissions, a few years ago, received the Queen's sign-manual, but an act has been passed dispensing with this necessity. For information on the subject of first and subsequent commissions in the army, *vide* Queen's Warrants (Appendix A).

**Commissionaires** (French *commission*, a message)—A body of old or disabled soldiers, who, on being pensioned, are formed into a corps, and stationed in London and Edinburgh. They are employed, for the most part, as porters and in positions of trust, such as door-keepers over jewellers' shops. They run also as messengers. They must be men of unexceptionable character to whom these posts and duties are entrusted.

**Commissioners of Array**—The predecessors of our modern lords-lieutenant, whose duties consisted, amongst others, of seeing enforced in feudal times the observance of regulations which had for their object the maintenance of able-bodied men in the realm for the protection of the land. (*Vide* Assize of Arms.)

**Committee**—Another name for **Board.** (*Vide* Board.)

**Common Shell,** *vide* Shell.

**Communications**—In a military sense, are the lines by which an army communicates with its base from any point to which it has advanced in the theatre of war, along which its reinforcements and supplies must pass to reach the army, and by which it must retreat in case of disaster; and the definition applies equally whether the army occupies an extended strategical front or is united on a field of battle (Macdougall). (*Vide* Lines of Communication.)

**Company**—In the army, means a body of men forming one of the principal divisions and the first unit of an infantry battalion; the number of companies in a battalion is usually about ten. The number in a company varies according to circumstances, but may generally be said to be about 100. A company is commanded by a captain, and has two subalterns attached to it. In the artillery service, the term *company* is exploded, and the word *battery* has taken its place.

**Compassionate Allowance**—In the British army, is an allowance granted to the widows and children of officers either killed in action or who die of wounds received on active service. The gift arose on the occasion of the Crimean War. If the allowance, as explained in 'Chambers's Encyclopædia,' "be in the form of a gratuity, in one sum of money, it bears a certain definite relation in amount to the sums which the officer had paid for the purchase of his commission, but the recipients have the alternative of a pension or annual allowance."

In the Indian army a similar allowance is given to the widows of officers who are killed in the service, or who die of their wounds; it is paid to them as long as they remain unmarried.

**Compliment**—The military mark of respect shown to all persons in authority by a body of troops, to a member of the royal family, to a general officer in command, to troops on the march, and to an individual officer when met by one or more of his subordinates.

**Compressed Bullets**—Bullets formed of compressed lead. The mode of compressing the lead is as follows. The lead is first melted, and then raised from the reservoir in a bucket by a small crane, and poured into the receiving chamber of a hydraulic press of immense power. A piston rising from below, and worked by a pump, is set in motion by a steam engine, and when the lead is cooled down to the proper temperature, it is forced through a die, forming it, as it escapes, into rod lead, which winds itself on to a drum of about the diameter of the *required bullet.* It is then *carried on to the bullet* machine, where it unwinds and divides itself as the machinery revolves, and is guided to a cutting apparatus, which nips off a cylindrical piece of lead; as the piece falls down, it is caught by a punch and die, fixed exactly below, which forms it into a perfect bullet in one stroke. The object of compressing the lead, instead of casting it, is to give density to the bullet and to prevent air holes forming within it.

**Compression, Globe of**—A surcharged mine, so called from its compressing or disturbing effects beyond the sphere of its crater.

**Compressor**—A brake or check attached to a gun-carriage to ease the recoil. Its controlling power is great. Garrison truck carriages, known as the single-plate and double-plate carriages, were originally fitted with the American and Elswick compressors, but later instructions direct them, when sent in for repair, to be replaced by the hydraulic buffer.

**Compulsory Service**—The power a government has of compelling the people of a country to take up arms in defence of the nation. This nature of enlistment is unknown in the British army, except in the militia, and then only in case of a deficiency of recruits; but in continental armies the system is universal.

**Comrade**—A fellow-soldier in the same regiment or company, and who acts as the friend of another soldier.

**Concave**—Hollow, such as the inner surface of a sphere, as opposed to its outer, which is termed convex.

**Concentric**—Having a common centre. The internal hollow sphere and the external figure of the outside of a shell are concentric spheres.

**Concussion**—A substantive used as an adjective in connection with the word "fuze." It is best represented in Saxon English by the word "shock." The concussion fuze, which is now obsolete, had an internal mechanism, so nicely adjusted as to withstand the first shock which the shell receives—viz. that occasioned by the explosion of the charge—and resisting others that may be occasioned by grazing short, while it yielded to the concussion caused by the impact of the shell on the body struck. This concussion, by shaking the burning composition of the fuze into the loaded cavity of the shell, instantly caused the latter to explode. Freeburn's concussion fuze answered to the above description.

**Condenser**—An instrument for forcing a large quantity of air into a given space. It consists of a receiver, a cylindrical barrel furnished with a valve opening inwards, and a solid piston, which is either air-tight or has a valve also opening inwards. Near the top of the cylinder, on one side, there is a small orifice. The principle of this instrument, which is nothing more than a force-pump, is this, that when the piston is forced down the cylinder, the air contained in it opens the valve at the bottom, and a barrel of common air is forced into the receiver. On raising the piston, the bottom valve closes, and when the piston rises above the orifice near the top of the cylinder, the air rushes in and fills the barrel again. This process is repeated as long as is necessary.

**Condensing Engine**—Called also a low-pressure engine, "is one in which the steam is condensed so as to present nearly a vacuum on one side of the piston, while the steam is acting on the other. As the pressure of the air on a vacuum is about 15 lbs. on the square inch in a condensing engine, the pressure of the steam in the boiler need not be so great as it necessarily has to be in a non-condensing engine, where the pressure of the air has to be overcome before any effective force can be obtained. Hence condensing engines are called *low-pressure*, while non-condensing are called *high-pressure*."

**Conductors**—Warrant officers attached either to the Ordnance or Army Commissariat Departments. The rank attached to these well-deserving officers is more applicable to the Indian than the English army. Those in the former department in India are chiefly men who have risen from the artillery ranks. The warrant rank comprises the following grades: sub-conductor, conductor, deputy assistant commissary, assistant commissary, and deputy commissary. The three latter are strictly departmental, and carry with them honorary rank, and are held also by commissioned officers holding unattached rank. Advancement is obtained by rotation in the Ordnance Department, each man entering first as a magazine sergeant, promotion afterwards being to the warrant grade of sub-conductor, if duly qualified, which is ascertained by the candidate undergoing an examination under the orders of the Deputy Inspector-General of Ordnance.

The term "conductor" was originally given to warrant officers, from the fact of their conducting stores by land or water to the several arsenals or magazines.

**Conductors, Lightning**—Metallic rods (copper generally) erected or attached to buildings to conduct lightning to the earth. Conductors are attached to all powder magazines, to preserve them from being struck by the electric fluid. For all particulars as to the mode of attaching the rods, *vide* Appendix G.

**Cone**—A solid body or figure having a circle for its base, and its top terminated in a point or vertex. The following geometrical description of a cone is taken from Taylor's 'Geometrical Conics':—"From the centre of a circle draw a straight line at right angles to the plane of the circle, and in this line take a fixed point. Then the surface generated by an indefinite straight line which moves so as always to pass through the fixed point, and through some point in the circumference of the circle, is said to be a *right circular cone*, or simply a cone."

**Confidence**—This term, in a military sense, has reference to the facility with which some officers gain the confidence of their men. This most essential quality in a commander is of the highest importance, and cannot be overrated,—without it, a disaster may at any moment occur in the day of battle; but with it, and the knowledge of military science combined, success in the operations of an army may be assured. History affords examples of battles having been lost by the most celebrated generals, because they did not possess this confidence.

At the battle of Thymbra, when Cyrus's horse fell under him, Xenophon takes notice of what importance it is to a commander to be loved by his soldiers. The danger of the king's person became the danger of the army; and his troops on that occasion gave incredible proofs of their courage and bravery.

**Confidential Reports**—Reports on regiments, as to their efficiency, conduct, &c., forwarded yearly by general officers commanding to the Adjutant-General for the information of the Commander-in-Chief. Reports on the qualifications of officers for promotion are sent to the Military Secretary at the Horse Guards for submission. The Queen's Regulations afford to general officers commanding, all information as to the preparation of confidential reports.

**Congreve Gun**—A 24-pr. gun of conical form; this gun was proposed in 1813 by Sir W. Congreve; it had a much greater thickness of metal at the breech than those of the old construction; the extra thickness was supposed to give a reacting power to the gun, which, however, is an erroneous idea, not supported by facts. The gun is now obsolete in the service.

**Conjunctor**—One of the three principal parts composing Navez's electro-ballistic apparatus. It is thus described by Captain Noble, late R.A., in the 'R. A. Institution Papers,' vol. iii. p. 117:—

"The current which passes through the second screen holds, by means of an electro-magnet, a weight suspended over a spring, a point from which is kept just over a cup of mercury. When this weight is permitted to fall, it presses the point into the cup of mercury, and completes the circuit, magnetising the horse-shoe magnet which clamps the vernier needle. This part of the apparatus is termed the conjunctor. The action of the instrument is very simple, and readily understood. When the projectile cuts the wires in the first screen, the magnet which holds the bob of the pendulum in its initial position is demagnetised, and the pendulum commences an oscillation. When the wires in the second screen are cut, the weight of the conjunctor drops, completes the circuit, clamping the vernier, and the arc through which the pendulum has moved is a datum from which may be computed the corresponding time."

**Conoid**—A figure generated by the revolution of a conic section about its axis. It is, therefore, three-fold, answering to three sections of the cone—viz. elliptical-conoid or spheroid, hyperbolic-conoid, and parabolic-conoid.

**Conscription**—A compulsory enrolment, by lot, of a certain number of the inhabitants of a country for service in the army. In England this system is not resorted to, but is in nearly all of the continental armies.

**Conscripts**—Men raised by most of the continental nations, and under certain laws, to recruit their armies. The militia of Great Britain comes likewise under this appellation when raised by ballot (which happily is not the case at present), but with this difference, that the men do not march out of their native country unless they volunteer to do so.

**Constipation**—In horses, is brought on from confinement, too little water, dry feeding. The symptoms are, belly swollen, dung dry and hard. The cure is, meshes or green meat, clysters, and exercise.

**Contingent**—In a military sense, implies the quota of armed men, or pecuniary subsidy, which one state gives another.

**Contouring**—A term applied to the outline of any figure, and consequently to that of any section of a solid body; but when used professionally in connection with the forms of ground or of works of defence, the outline of a horizontal section of the ground or works is alone to be understood by it.

**Contraband of War**—All such articles as a neutral power is prohibited by the law of nations from carrying to countries at war with one another, such as arms, ammunition, coal, food, &c., or to carry on any trade with blockaded ports or besieged towns. All the articles enumerated above are liable to be seized, and are considered contraband of war. The subject of what is contraband of war is so arbitrary, and depends so much on the interpretation given to the term by powerful states, able by force of arms to dictate what is contraband, that it renders the position of neutrals and belligerents to each other one of great difficulty. One thing, however, should be remembered, that there is a great difference between carrying contraband articles to the belligerents, and allowing either of them to buy such articles in a neutral territory.

Some authorities support the principle that it is neither beneficial nor expedient for England to prohibit the export of arms and munitions of war to belligerents, and amongst them Lord Penzance, no mean authority on such a subject.

Whatever the opinions on contraband of war may be, the Foreign Enlistment Act renders it illegal in any person to enlist in the service of a foreign state, or to build any ship with intent or knowledge that the same will be employed in the military or naval service of any foreign state at war with any friendly state; and special powers are granted to the Secretary of State to take any step to prevent the commission of such an act.

**Contraction**—The state of being drawn into a narrow compass, or becoming smaller. In horses' feet, it is brought on from bad shoeing, hot stables, confinement. The foot becomes oblong, instead of round. The remedy to be applied should be thin sole and quarters, and the feet kept moist; also tips or spring shoes, tar or hoof ointment, composed of tar and tallow, each 1 lb., common turpentine, ½ lb., melted together.

**Contravallation**—The name given to a belt of field works thrown up around and facing the place invested, to render the besiegers secure against surprise.

**Control Department**—One of the civil departments of the British army, having for its object an efficient and economical control over the departments it supervises.

It may be said without exaggeration to be one of the most important departments, for on it depends the custody and supply of all stores, whether of food or ammunition, the provision of transport, &c. It takes the place of what was formerly the commissariat department, in addition to other duties, such as were formerly in the hands of the Quartermaster-General. Without the thorough efficiency of this department, no army can exist in the field; failure would probably entail defeat and all the disasters attending such a calamity. We have an instance in the Franco-Prussian war of the disasters likely to occur to an army whose commissariat is unequal to the demands upon it. Take the case of the French army at Sedan, which, it is said, from want of proper commissariat arrangements, was one of the causes that prevented it from effecting the relief of Metz, and was consequently overwhelmed by the Prussian army. The Control, as at present organised, is comparatively a new department. The history of its formation is to be found in the various Blue Books on the subject, dating back to 1859; but it was in the year 1870 that the department was consolidated, and divided into three administrative ranks, viz.:—

Controller's, ranking with a major-general;
Deputy Controller's, ranking with a colonel;
Assistant Controller's, ranking with a lieutenant-colonel;

and two executive sub-departments:—

1. *Supply and Transport*, which include the issue and account of stores and provisions, superintend and direct all transport, officer and command the Army Service Corps.
2. *Pay*.

For the management of the supply and transport, three commissaries are attached who command the Army Service Corps, and who rank as follows:—

Commissary, with major.
Deputy „ „ captain.
Assistant „ „ lieutenant.

For the duties of the pay department there are three grades of officers, viz. paymaster, deputy paymaster, and assistant paymaster, ranking in the same position as laid down for commissaries. First appointments in the executive branches of the Control Department are conferred on civilians selected by competitive examination, or on subalterns of the army and well-deserving non-commissioned officers. The limit of age is 17 to 20 for civilians, 22 for subalterns of the army and militia. In the regulations of 1870 for the Control, it will be found that the first ten paragraphs relate to general duties of the department, and 11 to 18 lay down the duties of control officers towards the general officer commanding. These instructions show that the control officer is independent of the general in command, in being able to communicate direct with the Secretary of War—which means that the Control Department is under the War Office, instead of the Commander-in-Chief, which appears to be a mistake. On this point most military men are in accord, and there is in *Blackwood's Magazine* for October 1874 a very good article on the subject of the Control Department, showing its unsuitableness, as at present constituted, either for war or peace. The article is written by a general officer of great experience, General Lysons; it is full of good sense and military knowledge, and may be taken as the view entertained by most military men who have passed their lives in the field. A return to the old organisation of the commissariat department seems to be demanded, and will doubtless be reverted to before long: it was sound and good; it stood the test of years of practical experience; it grew under the hard hand of necessity; it carried our army through all the difficulties of the Peninsular War, and led our troops to victories the most brilliant in the annals of our history. The compiler of this work can speak with authority as to the efficient working of the commissariat in India, which has never been known to come short of its requirements. It is unadvisable to mix up, in one department, supply, store, passage transport, and half a dozen other things, each of which should be a department of itself. To crowd department upon department under one head, and to expect efficiency, is simply courting failure.

On the formation of the Control, the following separate branches of the army were amalgamated with it, viz.:—

Commissariat,
Barracks,
Military stores,
Purveyor's,
Army transport,

then known as the military train, to which a large number of civil and military employés were also attached, dispersed in a variety of sub-departments, having no connection with each other.

The Control Department is presided over by a Surveyor-General of Ordnance at the War Office, who has under him a Director of Transport and Supplies, and a Director of Military Stores. The administrative branch consists as is shown above.

**Controller**—The chief or highest grade in the Control Department. He ranks with a major-general.

**Contusion**—The effect of a ball or of any other hard substance striking the human frame, or even the passage of a ball close to the limb, without breaking or tearing the skin. The effect of this latter kind of contusion, which is caused by the concussion of the air, is often to disable the soldier, and is in fact a wound.

**Convalescent**—A soldier discharged from hospital, but who is not strong enough to do his duty.

**Convalescent Hospital Depots**—Encampments of huts or tents for the reception of men discharged from the general hospital, and who require no longer medical attendance, but at the same time are not fit to join the ranks, from want of strength. Such depots relieve the general hospital, and are better places for the convalescent than a crowded sick room, as they are removed from a bad atmosphere, and have consequently a better chance of gaining strength. As regards hospitals, the Medical Department is responsible for the use of all stores, and for timely requisitions, but the Control Department is responsible for such stores being supplied.

**Convention**—An agreement entered into by troops which are opposed to one another, either for the suspension of hostilities or the exchange of prisoners.

**Conversion**—A term used in ordnance nomenclature when condemned stores are converted or turned into use for other purposes. The term is made use of when smooth-bore guns are converted into rifled guns.

**Converted Gun**—A smooth-bore gun converted or turned into a rifled gun. In England this process has been carried out by Major Palliser, who has successfully lined many of the cast-iron guns with a wrought-iron tube, and has rifled the same, thus turning or converting the smooth-bore into rifled guns.

Of converted guns there is the Dutch, which resembles that of Major Palliser, with the substitution, however, of bronze for the coiled wrought-iron tube. This is not considered a good conversion.

Many of the American smooth-bore guns have been converted on the Parsons system. The main construction is the same as the Vavasseur gun, being a steel tube, reinforced with a long jacket of steel; but Mr. Parsons dispenses with the exterior hoops of steel, and inserts his reinforced tube into an outer casing of cast iron. Captain Simpson, of the United States, who inspected all the European systems of conversions, recommends the adoption of the Parsons system, combining with it the arrangement of Krupp, and taking the Broadwell ring for a gas-check; but the Americans are now rifling their smooth-bore guns on the Palliser system, and, it is stated, with great success.

**Convoy**—A guard of troops composed of all arms, and employed to escort any supply of money, ammunition, stores, provisions, &c., in time of war to an army or fortress.

**Copal**—A resin next in durability to amber, almost colourless, and softer than amber, though too hard to be scratched by the nail. Copal forms an excellent material for varnish. Pure alcohol has little effect on copal; with the addition of camphor it dissolves, but the camphor impairs the durability of the varnish. Copal may be perfectly dissolved by ether, but it evaporates too rapidly to allow of the varnish being uniformly applied. Copal is, therefore, usually dissolved by fusing, and adding linseed oil heated nearly to the boiling-point.

**Copper**—A metal of great value, and known from the earliest ages. It is found in different parts of the world, and in combination with other substances, as an ore. The great supply to the English market comes from the mines in Cornwall, Devon, Australia, and from South America. To bring copper to a state of purity, it has to go through successive repetitions of roasting, calcining, melting, and refining, and this in Great Britain is chiefly carried out at Swansea, in *South Wales,* where there are large *smelting furnaces.* It is used as an alloy with many other metals, amongst them with tin in the manufacture of bronze guns. Copper alone is a very malleable metal, but on being mixed with tin becomes tough and well suited for all articles of bronze. Copper melts at a temperature of about 2000° Fahrenheit. It is a good conductor of electricity, and is, therefore, made use of for lightning conductors.

**Copper Rod**—Copper in the form of a rod; it is used for lightning conductors of magazines. The rods so used are either solid or tubular, varying from ½ inch, if solid—¾ inch is preferable—to 2 inches in diameter, if hollow, and about ⅕ inch thick; 3 inches in length, and screwed to one another. Conductors, when placed in an upright position, are supposed to protect a circular space the radius of which is double the height of the rod. Iron conductors can also be used, but under these circumstances the top must be of copper, tipped with platinum or gold. (*Vide* Lightning Conductors.) In the Appendix will be found considerable information on the subject of lightning conductors.

**Copper Scissel**—The clippings of copper left after the formation of percussion caps, friction tubes, coinage, &c.

**Copper, Sheet**—Is copper rolled out into broad plates. There are two kinds, thick and thin. The former comprises all copper of and above 50 oz. to the square foot; the latter, all under this weight. Thick sheet copper is used for the hoops of powder barrels, and for drying pans; the thin for percussion caps, friction tubes, &c., and the lining of magazine doors. Muntz's patent metal is a cheap substitute for copper sheeting.

**Cordage**—The term is applied to every description of rope used in the artillery service. (*Vide* Rope.)

**Cordon**—This term was formerly given in a fortification to a round projection of stone, also called the *coping-stone,* about 1 foot in diameter, placed at the top of the revetment of the escarp to prevent the rain from damaging the masonry, and to form an obstacle to the besiegers when applying the ladders for the purpose of an escalade. A cordon in the field is a chain of outposts or sentries or flying vedettes, to blockade a position and intercept all communications with the outside.

**Core**—A bar of iron coated with clay, which is inserted into a finished gun mould, when the gun is to be cast hollow, termed "casting on a core." Casting guns is no longer resorted to in the British service, as the pattern gun is of wrought iron coiled round a steel tube. In the United States service, it has until very lately again been reverted to, the practical difficulties that hitherto interfered with this mode of casting having been surmounted by Captain Rodman's (of the United States Ordnance Department) system of casting; but it is stated that the Rodman guns are being converted and made into rifled guns after Captain Palliser's system. A core is also used in casting shells or anything hollow.

**Cornet**—Formerly the junior commissioned rank in the cavalry branch of the service. The rank has now been abolished in the regular army, and sub-lieutenant substituted for it. The name is still kept up in the junior grade of commissioned officers in the yeomanry. The cornet's duty was formerly to carry the standard—but it is now carried by a troop sergeant-major.

**Corning, or Granulating**—That process in the manufacture of gunpowder which takes place after the cake is removed from the hydraulic press—having been previously broken down—to the granulating house, when it is passed through rollers and sieves, until the different-sized grains are formed. Corning is another term for granulating.

**Coronet**—That part of a horse's foot termed the little pastern, just above the coffin bone.

**Corporal**—The rank below that of sergeant, the lowest of the non-commissioned officers. Corporals of artillery take precedence of corporals of cavalry and infantry, according to the date of their appointment as bombardiers.

**Corporal Punishment**—The infliction on the bare back, by means of a cat-o'-nine-tails, of a certain number of lashes for crimes committed by soldiers. Except for very grave offences, such punishment is seldom resorted to in the army, and then only during war *time or on board* ship. The number of lashes is limited to 50.

**Corps**—Any body of forces destined to act together under one commander. The term is commonly made use of by military writers in speaking or writing of an army corps.

**Corps d'armée**—Army corps. One of the sub-divisions, and the first unit of a large army. (*Vide* Army.)

**Correspondence, Military**—The mode adopted for carrying on communication between the several branches and officers of the army relating to duty. It is carried on as follows:—

1. By letters.
2. Memoranda.
3. Minutes, papers, or dockets.

The first method is formal, generally lengthy, and is for the most part supplanted by memoranda.

The work of the Adjutant-General at the Horse Guards is carried on by letter.

Any new or important report in the form of a letter is safest from an inferior communicating with a superior, and should be written on foolscap, half or quarter margin. The letter should refer to one subject only, but contain the fullest particulars on that subject. If lengthy, and in paragraphs, number each. If any enclosures, they should be noted in the margin. Memoranda are abbreviated letters, leaving out all formalities and readings.

Answers to letters, remarks made by superior officers in transmitting them, correspondence between departments in a division, should be carried on by memoranda.

Turning down corners to be avoided.

Communications to a superior must be signed by the commanding officer writing it, and addressed to the staff officer of a superior. Every communication from a superior is addressed to the person himself, and signed by the staff officer of the superior. There are a few cases where an inferior signs.

Application for routes are generally signed by the Quartermaster-General. Letters signed by a staff officer are always signed "By order." In the absence of the general, and when the matter is pressing, the staff officer signs "For general commanding" when communicating with the Horse Guards.

In indirect correspondence between equals, letters must be signed "general" or "head of department," if addressed to a general or head of department, but two generals can carry on a correspondence through their staff.

Staff officers communicating with each other sign their own name without "By order."

The date of receipt of a letter, how disposed of—transmitted, granted, refused—should always be recorded.

In the War Office there is a special department for opening and registering letters.

In ordinary divisions, letters are opened by persons to whom they are addressed. All letters written by the general should be initialed in the register.

All letters remain permanently with the person to whom they are addressed, unless they have to be forwarded to higher authority. Any Horse Guards letter with the Adjutant-General's or Quartermaster-General's stamp on it are to be returned after perusal and being acted upon.

All papers transmitted for information should be signed or initialed, and dated before being returned. Superior officers should dispose of all letters they can, and only forward to higher authority such as require to be taken notice of by such authority. In cases of absolute necessity they should forward their own opinion, and all other opinions and correspondence that bear on the subject.

In every office there should be the following books:—

Register or diary,
Letter books;

also a table showing returns which have to be received and made.

FORM OF REGISTER.

| No.* | Date. | Who from. | Subject. | How disposed of. | Sent to. | Date. | Remarks. |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

* No. for further reference.

**Corrosive Sublimate**—Is described as "the bichloride of mercury. It is formed by introducing hot mercury into chlorine gas; the mercury inflames, and the bichloride is formed. There are other ways of preparing it. What is termed kyanising is applying this substance to the preservation of timber, cordage, sail, tent cloths, and other fabrics from decay by mould, or the ravages of insects. This mode of preserving the articles mentioned is the invention of Mr. Kyan."

**Corrugate, To**—A mode of rendering sheet iron very tenacious and durable. The sheet iron is coated with zinc, and compressed by means of dies into plates. This kind of iron is extensively used for roofing, for military wagons, boats, &c.

**Corslet**—A suit of armour, chiefly worn by pikemen. The word, strictly speaking, meant only that part covering the body, but was generally used to express the whole suit, including head-piece and gorget; the back and breast, with shirts of iron called tapes or tapets, covering the thighs.

**Cossacks**—A people inhabiting those parts of the Russian empire which border on the northern dominions of Turkey, Poland, and the southern confines of Siberia. Both the name and origin of this people are involved in great uncertainty. They seem to have none of the national characteristics of the Russians, and are probably a mixed Caucasian and Tartar race. They form a sort of independent republic, paying no taxes to Russia, but cheerfully contributing their numerous and valuable contingent of men, which are well known as the most harassing light troops that ever exercised a predatory warfare in the train of any army.

**Cottah**—A Madras weight, equal to 16 chuttacks.

**Cotton Waste**—The refuse cotton collected in cotton mills. It is used for wiping machinery, and should be put away with care in some out of the way place, when the work of the day is over, or saturated in water with a solution of soda and boiled, when the oil will be extracted. In its oily state with particular oils, such as vegetable oils, it is liable to spontaneous combustion, and should not therefore be left about. It is very dangerous, as will be realised, to leave it in houses where gunpowder is manufactured. It is not at all unlikely that the explosion in many gunpowder houses, the reason of which has been unknown, has been caused from cotton waste containing oil having been left in the houses at night, and thus ignited the building or buildings. In some cotton waste itself there are the elements of fire.

**Coullart**—A military instrument of war used in the early part of the fifteenth century. It was used for the purpose of casting great stones.

**Council of War**—In the field or elsewhere, an assembly of the senior officers of the army, called together by the officer in command, to concert measures for the future conduct of affairs.

**Counterforts**, *vide* Buttresses.

**Counterguard**—In fortification, is a reveted work consisting of a narrow rampart and parapet, parallel, or nearly so, to the face of the bastion which it covers, and which must be destroyed before the bastion can be breached; for, from want of sufficient breadth in the terreplein, the batteries of the attacking party cannot effect a lodgement. Counterguards are sometimes constructed before the salients of the ravelins.

**Countermarch**—A change by wings, companies, and sub-divisions, whereby those who were on the right take up the ground originally occupied by the left, and *vice versa*.

**Countermines**—Mines or galleries excavated by the defenders of a fortress, to intercept the mines and destroy the works of the besiegers.

**Counterscarp** — In fortification, the revetment of the ditch forming the support of the covered way, opposite the escarp.

**Counterscarp Galleries**—In fortifications, are galleries formed in the counterscarp, to provide flank defences for a ditch. They are formed of stockade work, loopholed and roofed over similar to a caponier. The entrance to the gallery should be closed by a strong-door. Counterscarp galleries should be placed at the salient angles. They have the advantage of being quite safe from the enemy's artillery fire, but are difficult to communicate with, and much isolated from the rest of the work.

**Countersign**—A watchword or number given daily in time of war by the commander of an army to the force under his command, in order that friends may be distinguished from foes; it is exchanged between guards, and entrusted to those employed on duty in guarding the camp or garrison. Before the enemy, the countersign must be given by every one who approaches a sentry's post, otherwise he will not be permitted to pass.

**Countervallation**, *vide* Contravallation.

**Coup-de-main**—Sudden and successful attack on any position.

**Coup-d'œil** (French)—A glance, a prospect; its military signification is the art of distinguishing at first sight the weak points of an enemy's position, and of discerning the advantages of which any given space of country is susceptible.

**Court of Inquiry**—A board of officers (who are not sworn) assembled by any officer in command, to assist him in arriving at a correct conclusion on any subject on which it may be expedient for him to be thoroughly informed. Such a court has no power to administer an oath, except when convened to record the illegal absence of soldiers. This nature of court is not to be considered in any light as a judicial body.

**Court-martial**—A military tribunal appointed under the provisions of the Mutiny Act, for the investigation and punishment of all offences committed by officers and soldiers. There are several natures of courts-martial, viz. a general, detached general, district or garrison, and regimental; the assembly of either of which depends on the enormity of the offence to be tried, together with other attendant circumstances. On a march, a detachment court-martial may be convened by the senior officer in command. Formerly there was such a court as a company's court-martial, composed of soldiers themselves for the trial of offences committed against each other, but they are no longer permitted.

**Couvre-face,** *vide* Counterguard.

**Cover**—Expresses security or protection; thus, to land under cover of the guns, is to advance offensively against an enemy who dares not approach on account of the fire from ships, boats, or batteries. It likewise signifies whatever renders any movement imperceptible, as under cover of the night, under cover of a wood, &c. This term is also given to any shelter, such as "shelter trenches," which troops make for themselves against the fire of the enemy. Soldiers standing one behind the other in the ranks are said to cover each other.

**Covered Way**—In fortification, is a space about 30 feet broad from the counterscarp to the crest of the glacis, and completely surrounding the body of the place with its outworks, thus forming a secure road of communication all round the fortress, outside the ditch.

**Crab Capstan**—Consists of a barrel (in shape the frustrum of a cone) and framework of wood and iron, by which the barrel is supported in a vertical position with its base next to the ground. It is furnished with two levers, called capstan bars, which are passed through mortises in the head, and by means of which the barrel may be turned about on its axis. By means of the crab capstan, a few men acting at the bars can move weights which would be far beyond their strength if applied in the ordinary manner. If a crab capstan cannot be procured, the windlass of a gyn may be used as a substitute, the cheeks being laid on the ground and secured with pickets; or a temporary capstan may be rigged up by lashing four handspikes to the spokes and felloes of a limber wheel, which is turned upon the pintail of the dismounted limber.

**Cradle, Gun**—A frame-work of wood placed on the back of an elephant or mule for carrying field and mountain artillery in hill countries. An elephant can carry 1400 lbs., but in a hilly country his load should not exceed 1000 lbs. The cradle sent with the 7-pr. guns of 150 lbs. weight to Abyssinia was of wood; it was formed by the tree of the R.C.D. pattern saddle, and was suitable either for carrying the gun or its carriage and wheels. Two iron cradles have been introduced for the 7-pr., 224 lbs.—one to carry the gun, and the other the carriage, while the wheels are carried upon wheel arms on a third mule. Each cradle is fixed to the saddle-tree, and consists of a simple framework of iron. The gun cradle, with saddle-trees to which it is attached, weighs 16⅛ lbs., and the carriage cradle with saddle-trees, 16 lbs. ('Treatise on Military Carriages,' 1874.)

**Crane**—A piece of mechanism usually consisting of combinations of toothed wheels and pulleys, by means of which stores, materials, &c., are lifted from vessels to the yard or wharves. Cranes are of two kinds, fixed and movable. In the former, they are much more efficient, as greater power, by the interposition of wheels, axle and pulley, can be applied. Fixed cranes at wharves are generally made to revolve on a centre, so that the goods raised can be brought over the wagon or place of reception into which they are to be deposited. Small cranes are from 3 to 5 tons; large from 5 to 40 tons and upwards, that is, capable of raising these weights.

**Crank**—In machinery, is a bend in an axle by which a reciprocating motion in a rod is made to produce a revolving motion of an axle and of a wheel, which may be connected with it.

**Crater of a Mine**—The cavity formed in the ground by the explosion of a charge of gunpowder, gun-cotton, or other explosive substance.

**Crémaillères**—Indented or zigzag outlines, composed of faces and flanks nearly perpendicular to one another. The advantage of this trace is that it is easily applied to irregular ground.

**Crenellated**—Loop-holed.

**Crinière**, or **Manifère**—Small plates of armour used in the middle ages to defend the necks of war-horses.

**Cross**—The ensign or grand standard borne by the crusaders in the Holy Land. This gave rise to the word "cross" being given to the superior mark of distinction termed the grand cross belonging to certain orders, such as the Bath, Star of India, St. Michael and St. George.

**Cross-bow**—A hand weapon used in the early days of English history, between the twelfth and thirteenth centuries. During the reign of Henry V.—so it is stated in Lieut.-Colonel Luard's 'History of the Dress of the British Soldier'—"the cross-bow was a complicated and expensive weapon, and consequently often carried by the sons of knights, who were attended by one of their fathers' retainers, who carried the pavise. During the reign of King James I. a cross-bow man was regarded as on a level with a knight, a distinction in those days of great importance." "We enact that no knight's son who is not a knight himself, or a cross-bow man, shall sit at table with knights or their ladies."

"In the reign of Henry VII. the cross-bow consisted of two kinds: the latch, with its wide and thick bender for *quarrels*, and the prodd for *bullets*. Towards the close of his reign, Henry VII. forbade the use of the cross-bow; his object being to induce more frequent practice in archery."

The cross-bow appears to have been of earlier origin than is stated, the Sicilians and Cretans having been the originators. It is also said that it had been previously introduced *into England* by the Saxons at the time of Hengist and Horsa, about A.D. 457.

**Cross-lifting**—A term used in artillery in moving a gun in a direction nearly at right angles to its axis.

**Croupières**—Armour placed on the buttocks and haunches of war-horses in the middle ages, to protect them against the arms of the adversary.

**Crow-bar**—An iron bar, used as a lever to move heavy weights.

**Crowning the Covered Way**—In the attack of fortresses, the operation of forming lodgments on the crest of the glacis. This is sometimes done by assault, or by systematic approach. Any work on fortification will explain the means resorted to in carrying out either attack.

The term *crowning* is also used when troops surmount a hill or any obstacle, when they are said to have *crowned the hill* or *position*.

**Crown-work**, *vide* Horn-work.

**Crow's Feet**—Iron balls with four spikes, so arranged that when thrown on the ground, one spike always remains upright. They are used to impede the advance of troops, more particularly of cavalry. The spikes are sometimes cast without a ball, and sometime they are simply triangular pieces of iron with the points sharpened.

**Crucible**—A melting pot used in the chemical laboratory. Small crucibles, if made of earthenware, should be made to stand great heat, as when residuum has to be burnt, the crucible is put into the fire or over the lamp. Large crucibles are used in furnaces for melting metals.

**Crusher Gauge**—An apparatus used for the purpose of determining the pressure of all natures of powder in the barrel of a gun. For a description of the apparatus and its use, *vide* 'Proceedings of the Royal Artillery Institution' for November 1870.

**Crust**—In a horse the internal part of his foot which covers the more sensitive parts, and to which the shoe is immediately attached.

**Crystallisation**—The spontaneous arrangement of the particles of solid bodies in regular geometric forms. A tendency to such an arrangement is generally observed in solids which are gradually deposited from a state of solution, but sometimes in those which have condensed into the solid from the gaseous form, or in masses solidified after fusion.

**Cuirass** (French *cuir*, leather)—The cuirass was originally a leather garment, capable of resisting a bullet. In the French language, *cuirasse* means a breast-plate, and is known as a piece of defensive armour covering the body from the neck to the waist. The household troops (cavalry) wear the cuirass at the present day. For a time, after the campaign in the Netherlands, the cuirass was set aside as cumbersome and inconvenient, but was resumed on the coronation of George IV.

It has been urged that in consequence of modern inventions the cuirass is solely fit to adorn a museum of antiquities. The contrary has been proved on the field of battle. At the battle of Wörth during the Franco-Prussian war, the French cuirassiers derived great security from the cuirass. A French officer thus describes the value:—"Like the noise of hail on window panes, was heard the sound of the bullets on the defensive armour, but no cuirass was pierced, and cuirassiers were seen in large numbers dismounted, but unwounded."

**Cuirassiers**—Heavy cavalry, still kept up in some of the continental armies. There has been no such regiment in the British army since the Revolution in France, though the Life Guards and Blues may be so called, as they wear the cuirass.

**Cuissards**, or **Cuisses**—Strips of iron rivetted together, in the days of body armour, for the protection of the thighs.

**Cul-de-sac**—A place where troops are enclosed, and at the mercy of the enemy.

**Culmination**—In astronomy, is the act of coming to the meridian in the case of any star or planet, when it attains on any given day its greatest altitude in the heavens.

**Culverin**—Ancient name of a gun; it was at first the lightest and shortest, but afterwards the longest and heaviest, gun.

**Cunette**—A narrow dry or wet ditch in the middle of the dry ditch of a fort. It acts as a drain, and, when filled with water, as an obstacle to an attacking force. It is generally about 16 feet wide *and 6 feet deep.*

**Cupola**—A revolving shot-proof turret, formed of strong timbers, and cased with massive iron plates of 12 and 14 inches thick. In some systems of cupolas the tower is erected on a base which is made to turn on its centre by means of steam power. Within the turret, heavy ordnance is placed, and fired through openings made in the sides.

The term cupola is also applied to a blast-furnace in which iron is melted. It consists of a cast-iron cylinder, lined with sand or fire bricks, with openings at various heights in the side, for admitting the blast pipe where it is wanted. Near the bottom is an opening for letting out the liquid metal. The furnace is first filled with ignited coke, and as this begins to sink, alternate charges of coke and pig-iron are thrown in every ten or fifteen minutes.

**Cups, Tin**—Used with heavy breech-loading guns, and serve, in conjunction with the vent piece, to seal more effectually the powder chamber, and to prevent the escape of gas, which is very destructive to the angular face of the vent piece. The cup is placed between the end of the cartridge and vent piece. A small hole in it serves both for the passage of the vent fire, and also for the cup being easily placed in position. There are two sizes of tin cups, the low- and high-gauge. Low-gauge cups are only required for guns with iron breech bushes. The cup should be drawn out to the rear by means of a hook.

**Curb, Gunpowder**—A funnel-shaped iron border standing out from the incorporating bed of a gunpowder mill at an angle of 45 degrees, and 2 feet high, serving to keep the charge in the bed, and all extraneous matter out of it.

The word *curb* is understood in conjunction with a horse's bridle. The name is also given to an enlargement on the back of a horse.

**Curry Comb**—An iron instrument or comb used in cleaning a horse. This instrument should never be applied below the knee, as it is calculated to injure the back sinew.

**Curtain**—In fortification, the line of rampart that joins the flanks of two bastions together.

**Curtain Angle** — In fortification,

the angle formed by the meeting of the flank and the curtain.

**Curtains, Gun**—Targets used by artillery at practice, and usually made of coarse canvas.

**Curve**—In gunnery, the line described by a projectile in its course, termed the *trajectory*, which, being acted upon by gravity, does not move on in a horizontal or straight line, but inclines or bends towards the earth.

**Curve Line**—A line which is neither straight nor composed of straight lines. Of special curves, that described by a projectile is the only one that need be considered here in connection with gunnery. It is called the *trajectory*, and approximates closely to a parabola.

**Curved Fire**—When a projectile is fired so as just to clear an interposing cover, and then descend upon the object, the line of fire being perpendicular, or nearly so, to the front of troops or works to be destroyed,—such practice is termed *curved fire*, in order to distinguish it from ricochet. This kind of fire has been long employed to dislodge troops posted behind cover, by firing common shells from guns or howitzers. Smaller charges and higher angles would, as in ricochet, be required than for ordinary direct fire. In the 'Royal Artillery Institution Papers,' vol. viii. of 1873, it is shown in a paper by Captain Clarke, R.A., that the employment of curved fire at the siege of Strasburg by the Prussians, during the Franco-Prussian war, was very successful, a hidden escarp, at a range of 910 yards, having been breached with a 6-inch B.L.R. gun, with a charge of powder $\frac{1}{40}$ the weight of the projectile fired, which was 60 lbs.

At Shoeburyness, the same nature of fire has been carried on with a 64-pr. B.L.R. gun, the calibre of which was 6·4 inches, with a charge of $\frac{1}{40}$ the shell's weight, at which a range of 900 yards was obtained with an elevation of 15°, while the Prussian elevation was only, so it is stated, $7\frac{1}{2}$°.

The 64-pr. B.L.R. gun is no longer a siege train gun. An 8-inch rifled howitzer, throwing a shell of 180 lbs., has been introduced into the service, and *in its practice has fulfilled the conditions under which the breaches were made at Strasburg.*

In the breaching of a hidden revetment, Lieutenant E. Clayton, R.A., in his prize essay of 1873, on the "Principles which Regulate the Efficiency of Artillery Projectiles," writes as follows:—"We will now consider the conditions under which a hidden revetment may be successfully breached by curved fire.

"The object to be gained is that the projectile should graze the crest of the covering work, and strike the scarp wall at the desired point with the maximum of energy. The first thing to be done is to decide upon the gun and projectile to be employed.

"It is required that a projectile should strike the revetment at a considerable angle of descent, with sufficient energy to destroy the masonry. Now, in order that a considerable angle of descent may be obtained at a moderate range (from 1000 to 1500 yards), it is necessary that the remaining velocity should be low; and this may be obtained in two ways—by a projectile that has been fired originally with a comparatively high velocity, and has lost it rapidly; or by a projectile that has been fired originally with a lower velocity and a higher elevation, but has not lost its velocity so quickly.

"If the projectile has the same weight in both cases, the first result would be obtained by a short shell of large calibre, the second by a long shell of smaller calibre, the resistance of the air having a greater effect on the former than the latter. The question is, Which of the two systems would be preferable?"

The whole subject is very well discussed in the essay, and Lieutenant Clayton seems to think "that the gun and projectile chosen for breaching batteries should, for a certain weight of projectile, have the smallest calibre consistent with accuracy of flight of the projectile, with the charge necessary to obtain the required angle of descent at the average range of breaching batteries, and consistent with a sufficient capacity for bursting charge."

**Curvilinear** — Consisting of curved lines.

**Cutlass** (French *coutel* or *coutelas*, whence cutlass)—A broad curved sword, about 3 feet long, used by sailors. It was originally a military knife introduced in the reign of Edward I., A.D. 1272–1307.

**Cutters**—Implements used in workshops, also in foundries in boring ordnance. They are classed under several heads according to the work they are required to perform.

**Cylinder**—A solid figure generated by the revolution of a rectangle about one of its sides, which remains fixed.

**Cylinder Gauge**—An instrument used for gauging the dimensions of the barrel of a smooth-bore gun. The gauge must pass to the bottom of the cylindrical part of the bore; if it does not go freely to the bottom, the bore is too small; but if it goes down, the bore may still be too large and irregular in its dimensions. To ascertain this, the "star gauge" is used. A cylinder gauge is turned to the exact minimum or true diameter of the bore for each calibre. This cylinder is hollow, of wrought or cast iron, and its length is equal to its diameter. It has cross-heads at right angles to each other, one with a smooth hole of the same diameter as the cylinder staff, the other tapped for the screw of the staff socket.

**Cylinders, Iron**—Cylinders specially used for the conveyance of ammunition by rail. They hold either half- or quarter-barrels of powder or ammunition.

**Cylinders, Zinc**—Cylinders constructed for holding the cartridges of the Woolwich guns. Each cylinder holds one cartridge. They not only act as cases in the magazine, but also serve to bring the cartridge up to the gun. Each heavy gun has two cylinders, one for the battering and one for the full charge, which will contain either P. or R.L.G. cartridges.

## D.

**Dagger**—A short sword or long knife. This weapon is of very ancient date. It was in common use amongst the early Britons, during the ancient British period, 55 years B.C., and it appears to have been in universal use through succeeding centuries, when in the reign of Charles II. a double use was made of the dagger, in the infantry soldier sticking it in the muzzle of his firelock to serve as a pike. This was doubtless the origin of the bayonet.

**Dahlgren Gun**—A gun invented by the late Admiral Dahlgren, of the U. S. navy. In appearance, the gun is not unlike the shape of a soda-water bottle. In this gun every projection that can be dispensed with is suppressed, and the exterior form is produced by a continuously curved line, no angular points being formed by suddenly changing the diameter at the different points along the piece. The U. S. navy guns of this pattern are the 9-inch, 10-inch, and 11-inch shell guns. With reference to this nature of gun, it is stated that the experience gained during the "rebellion" in the United States was sufficient to show that smooth-bore guns were no match for armour. The Dahlgren 11-inch was once a formidable gun on the seas, but is now "robbed of its power."

**Dam**—An impediment formed of stones, gravel, and earth, thrown across a stream of water, by which, when required, it is made to overflow its banks, in order to inundate the adjacent country.

**Damages, Barrack**—Is the injury done to government property in the barracks lately occupied by a regiment. Fair wear and tear is permitted, but any undue breakage comes under the head of injury committed by the regiment which has just been relieved. These damages have to be made good, if good cause is not shown why they should not be, by the individual company or regiment which commits them. (*Vide* Queen's Regulations for the steps to be taken to recover the loss caused.)

**Dammer**—A resinous substance found in many parts of India; it exudes from different kinds of trees. That used in Bengal is yielded by the *Shorea robusta*, or the sâl tree. There are three kinds, the white, black, and coarse dammer, which appear to resemble the resin obtained from the pine. It is in very general use throughout Eastern and Southern Asia. In arsenals it is used to protect packages, &c., which are likely to be exposed to damp or wet in transit.

**Dart**—A lance thrown by the hand

This weapon is only known in ancient military history.

**Day, Apparent Solar**—As described in Milner's 'Astronomical Atlas,' "is the time included between the centre of the sun leaving the meridian of any place to its return to the same meridian again. It varies continually in length, owing to the unequal motion of the earth in its orbit, and the obliquity of the ecliptic, being sometimes more and sometimes less than 24 hours." *Artificial day* is "the time between sunrise and sunset, which varies with the latitude of places." *Astronomical day* is "the time reckoned from noon to noon, and consisting of the same length of 24 hours in all latitudes, called a natural day." *Mean solar day* is "the time which would elapse between consecutive returns of the sun to the meridian of any place, if moving in the plane of the equator with an equable motion. It is the mean of the true solar days throughout the year, and consists of 24 hours as measured by a time-piece, which, on some days of the year, is as much faster than the sun-dial as on other days the sun-dial is faster than the time-piece." *Sidereal day* is "the time which elapses between consecutive returns of any fixed stars to the same meridian, or, in other words, the period which the earth takes to accomplish one rotation on its axis. This period is unvarying and immutable—23 hours 56 minutes 4 seconds, which would always be the length of the solar day if the earth stood still in space, and only turned upon its axis."

**Day-book** — In keeping accounts, whether of a private, commercial, or military nature, such a book is indispensable. As its name indicates, it is a book in which daily transactions are inserted, to be subsequently entered in a ledger. It is a book recommended, in the accounts of a company, to be kept by the pay-sergeant. In all manufacturing and other establishments, stores issued and received are entered in the day-book.

**Dead-head**—In foundry, the mass of metal in excess of the gun's length, or any other casting. It serves to replace the diminution or contraction of bulk which takes place in the *cooling* of the metal, *also to add solidity and* compactness to the piece. In the casting of guns, the longer the dead-head the better. Before the piece is bored out, the dead-head is cut off, and remelted with subsequent castings.

**Deblai** — In fortification, earth excavated from the ditch to form the *remblai.*

**Debouch, To** —To march out of a defile, or narrow pass, or from a wood, village, &c.

**Debris**—Ruins of a building or town which has been sacked; broken remains of an army after defeat.

**Decamp, To**—To quit any place or position in an unexpected manner.

**Decimate, To**—This term is explained by Major Knollys, in his 'Handy Dictionary of Military Terms,' as follows:—"To punish troops who have shown cowardice, by executing every tenth man, the sufferers being fixed upon by lot. This is an old and obsolete punishment."

**Defaulter**—A soldier sentenced to confinement to barracks for some military offence.

**Defaulter Book** — A book in which the record of crimes committed by soldiers is entered. There are two defaulter books in a regiment, the *company* and the *regimental.* In the former all offences of whatever description committed by non-commissioned officers and soldiers, whether punishment may have been awarded or not, and every act of drunkenness committed by a soldier, are inserted. Cases of absence, which may be considered equivalent to drunkenness, are not to be so numbered, but in lieu thereof the letter D is to be inserted in *red ink* opposite every such case, by the officer commanding the company. All offences are to be inserted in the officer's own handwriting. In the latter, or regimental defaulter book, all punishments awarded by the commanding officer of the regiment, or by courts-martial, are inserted. In this book also all offences are to be entered for which a punishment exceeding 7 days' confinement to barracks has been awarded.

**Defeat**—The rout or destruction of an army by an enemy.

**Defence**—The means resorted to of defending oneself against the attack of an enemy. In fortification it is the art of protecting or strengthening all works liable to attack, whether in permanent or field works. In the former, which relates to fortresses, such means are used, when the siege of the place is anticipated, to strengthen all fronts which are likely to be attacked, and in seeing that the armament of the fortress is to the extent required for successfully resisting the besiegers. In field works, the defensive arrangements made for their protection will depend on the nature of works or positions to be defended. Much must be left to the ingenuity of the commander of the post. Everything that hand can be put on comes in for the defence of buildings, hedges, and walls. Any work on fortification will explain the general mode of defence used under such circumstances, and it is very necessary that all officers should be so instructed as to be able, when in command of an outpost, to put it into a state of defence.

In the work entitled 'Instruction in Fortification, &c., at the Royal Military Academy, Woolwich,' the following is stated to fulfil the conditions of all works of defence:—

"1st. They should afford cover to the defenders from the projectiles of the enemy.

"2ndly. They should permit the defenders to use their own weapons with the greatest effect upon the enemy, from the moment that he comes within range until his arrival at the crest of the defenders' works.

"3rdly. They should present obstacles to the advance of the enemy, so as to check him under the fire from the work or works, and prevent him closing with the defenders."

**Defence, Flank,** *vide* Flank.

**Defilading**—In fortification, is the proper arrangement of works and the determination of the height of the parapets, in order to give proper cover to the defenders and to parry the effects of commanding ground. Works were formerly defiladed against musketry, within *400 yards;* and against artillery, within *1200 yards or upwards.* This was the distance with smooth-bore arms, but in the future it will doubtless be modified in consequence of the increased range of rifled arms.

**Defile**—A narrow passage or road, in marching through which the troops can present only a small front. If artillery, on its march, is unaccompanied with any other troops, and is opposed by such an obstacle as a defile, or a steep ascent in mountain passes, &c., the head of the column must endeavour to pass it rapidly, and the drivers of the succeeding carriages should be warned of it, that they may be attentive to keep their distances and ranks. In time of war, neither artillery nor cavalry would be permitted to enter a defile until it had been first explored and its flanks secured by infantry.

**Deflagration**—A chemical term: it is understood to mean every process of decomposition attended with noise or detonation.

**Deflection of a Projectile**—Is the distance of the trajectory to the right or left of the line of fire measured perpendicularly. (*Vide* Deviation.)

**Degree**—The 360th part of the circumference of a circle; 60 geographical miles.

**Deliquescence**—The power that certain salts have of attracting moisture and dissolving into water. Saltpetre has generally many deliquescent and impure salts in it, which in the process of refining it is freed from before being used for gunpowder purposes.

**Demi-bastion**—In fortification, a work which has one face and one flank cut off by the capital.

**Demi-lune**—In fortification, a work having two faces forming a salient angle towards the country, and covering the curtain connecting the shoulders of the adjoining bastions. A ravelin is a demi-lune.

**Demolition of Artillery**—The destruction of ordnance by artificial or other means. This is performed, if the gun be an iron one, by half filling the piece with powder, and jamming in one or two shot with stones, bits of iron, &c.; over this a complete tamping with stones and earth till the bore is filled. To break off the trunnions is not always an infallible mode of destroying ordnance, as they can still be fired from the ground. When time admits of only partially crippling guns, by removing one of the trunnions, it is best done by laying the end of the trunnion on a block of wood, the blow being given by a sledge hammer, or (if that be not at hand) by heavy shot. A gun may be destroyed by firing a shot at it behind one of the trunnions, which, if it should not break it, would render it unsafe. The first method, however, particularly if the muzzle is partly buried in the ground, will be found certain to burst the gun. To render bronze guns unserviceable, fire a shot into them from some other piece, behind the trunnions, which will prevent the possibility of their being used again.

**Demolition of Works**—The destruction or razing to the ground of a fortified or other work. When there is time, this operation is performed by mining or blasting, in which gunpowder, gun-cotton, dynamite, or any other explosive compound, may be used. "In demolishing a revetment wall, shafts should be sunk along the back at certain intervals (usually two or three lines of least resistance), the charge being placed within two or three feet of the bottom. These charges are all fired simultaneously by a proper arrangement of the hoses, or by an electric battery. If a house, such as a magazine, block-house, &c., has to be demolished, it would be done by blasting. In this case, blast-holes, having an inclination downwards, are bored in the walls at two- or three-line intervals as before. When the charges are required to be large, it is customary to bore the holes crossing each other in the shape of the letter V or X. When there is very little time, and the work has to be done hastily, the demolition is performed by firing large charges of powder, placed in the most effective manner. In a bridge, for instance, a large charge placed over the crown of an arch, the roadway having been previously picked up, would cause certain demolition; or in a building, two or three large charges placed against the walls in the rooms, the doors and windows being shut, would destroy the house." (*Vide* Appendix H.)

**Demonstration**—A term used in military operations signifying a feint on the part of the enemy or the opposing army, when some manœuvre or attack is to be undertaken in an opposite direction to that intended, whereby the attention of the enemy is drawn off from the real attack. Such often occurs in warfare.

**Densimeter**—An instrument for determining in mercury the specific gravity of the grains of gunpowder. The one in general use in gunpowder factories was invented some years ago by Colonels Malet and Barthélemy Bianchi, of the French artillery. Before the introduction of this instrument, the density of powder was arrived at by the immersion of the grain into liquids, such as turpentine, alcohol, &c., but no method has proved so accurate or satisfactory as taking the density in mercury.

The mode of taking the density is as follows. First exhaust the air within the globe or receiver; fill it with mercury, weigh it, and empty the globe. Then take 100 grammes of powder, which is the usual quantity employed, and introduce it into the globe. Exhaust the air again, and admit as much mercury as the globe will now contain; weigh this, and note down each weighing, viz. the globe filled with mercury and the globe filled with mercury and powder. Having accomplished this, proceed by the following formula to find the actual density of the powder:

$$D = \frac{D \times 100}{(P' - P) + 100}$$

Where D = specific gravity of mercury, which is found from a table of specific gravities of mercury at different temperatures;

P = weight of globe filled with mercury and powder;
P′ = weight of globe filled with mercury alone;
100 = weight of powder used.

The following is an example:

| | Grammes. |
|---|---|
| Globe and mercury only ... | 4190 |
| Globe with powder and mercury | 3495 |

Temperature at the time of weighing the mercury 60° Fahr., consequent specific gravity 13·59.

Then $\frac{13\cdot59\times100}{4190-3495+100}=\frac{1359}{795}=1\cdot709$ density required.

**Density**—The density of a body indicates the quantity of matter in it under a given bulk, and is synonymous with the term "specific gravity."

In the manufacture of gunpowder it is very necessary to attend to the density, as so much depends upon this all-important point in regulating the uniformity, time of burning, and strength of the powder. Experience has shown the density, most likely, under certain circumstances, to produce a good result in the different natures of powder manufactured, both as regards their action upon the velocity of the shot and the pressure upon the gun. A large-grained dense powder burns slower than a small-grained powder of low density, and tends to preserve the gun better, as it does not throw such a strain upon it; hence the reason that P. powder, which is a large-grained and dense powder, is used with all large ordnance.

**Departments, Civil,** *vide* Civil Departments.

**Deploy, To**—Literally to open, to extend. The term is used in the formation of a body of troops from column into line, or when it is required to extend the front of an army or body of troops.

**Depot**—A place of receipt and issue of commissariat and ordnance stores when the main magazines and arsenals are at too great a distance to be drawn directly upon by an army. In small garrisons in India, depots are usually in charge of warrant officers of the above departments. (*Vide* Magazines.)

The name is also given to a company left in England on a regiment proceeding on foreign service. The depot is attached in the case of second battalions of regiments to the battalion at home, or if both battalions are on foreign service, to a brigade depot of the sub-district to which the regiments are linked. Recruits and men unable to proceed abroad are attached to the depot, and subsequently drafted off to their regiments.

**Depot, Army Clothing**—A government *establishment at Pimlico* which furnishes the army with its regimental clothing. It also instructs certain soldiers in the art of tailoring.

**Depot, Brigade,** *vide* Brigade Depot.

**Depot, Cavalry,** *vide* Cavalry Depot.

**Depression Carriage**—A garrison carriage which admits of a depression of 30°. Such carriages are required for service at Gibraltar, where a great amount of depression has to be given to many of the guns in the batteries.

**Depth**—In military evolutions, applied to the space taken up by troops in column. Also the actual number of yards in depth taken up by regiments, brigades, &c., marching along a road in perfect order. (*Vide* 'The Soldier's Pocket Book.')

**Derivation**—In gunnery, a term used by the French to express the deviation, to the right or left of their path, of elongated projectiles fired from rifled guns. (*Vide* Deflection.)

**Derrick**—A sort of crane, principally used on board ship in hoisting heavy weights, such as taking out or putting in a mast. If used on land, it consists of a beam of wood, one end resting on or sunk several feet in the ground, the other supported at any convenient angle by guys.

**Deserter**—An officer or soldier on duty with his regiment leaving it without permission, with the intention of not returning to it again. The Articles of War punish desertion with death, but the power is only exercised before the enemy. A reward, under certain circumstances, is given for the apprehension of a deserter. The maximum sum is 40*s*., but this will depend upon the exertion and skill shown by the apprehender. In no case will a reward be granted if the deserter voluntarily surrenders, or if it can be shown that there was any collusion between the deserter and the person apprehending him. Nor will a reward be allowed unless the deserter shall have been committed to confinement by a magistrate as provided for by the Mutiny Act.

Any soldier absent without leave for more than twenty-one days must be tried for desertion by a court-martial.

**Desiccation**—The expulsion of moisture from solid substances. This is effected at various temperatures, according to the nature of the substance, and by different means, such as the water oven, air bath, &c. The wood of fuzes is thus treated.

**Despatch** — An official document or letter penned by the commander of an army in the field to the home authorities. The term is also applied to letters received from governors of colonies to the above-named authorities. All correspondence also from military commanders to superior authority in the field, detailing their acts before the enemy, come under the head of despatches.

**Detached Works**—Works so far in advance of the main works or fortress that they receive no support from the fire of either.

**Detachment**—A body of troops, varying in number and composition, according to the nature of the duty required. It remains with the general of a force to form the detachment of whatever troops he may see fit, and to use it as he may think necessary.

**Detachment, Gun**—Consists of a certain number of men told off for the service of each piece of ordnance. In the exercise of the various descriptions of ordnance, the same numbers, as far as possible, always perform the same duties, the detachments being told off upon the same principle, viz. beginning with the lowest numbers and proceeding to the highest, No. 1 always commanding. Not less than six men should be posted to any description of ordnance, and this number is only sufficient for light field-pieces. Heavy ordnance detachments vary in number according to the size and weight of the piece, the heaviest requiring 18 men and upwards, inclusive of the non-commissioned officer.

**Detonating Composition**—A term applied to certain highly combustible compounds, which, when suddenly struck, ignite or detonate. Such is the composition used, but in varying proportions, in the manufacture of percussion caps, Boxer's B.L. time-fuzes, copper and quill friction tubes, and Pettman's percussion fuzes. A detonating fuze is now used in firing damp compressed gun-cotton, and its application in this manner is a comparatively recent and very valuable invention. Still more *recent is the introduction* of electric detonators for submarine and other purposes attending the firing of explosive compounds.

**Detrain**, *vide* Disembarkation.

**Deviation**—In gunnery, the path or course a projectile takes oblique to the line of direction, caused for the most part from windage, and the non-homogeneity of the shot or shell, as well as from the friction and shocks which the projectile experiences during its passage in the bore, and which form the principal causes of irregularity in fire from smoothbore guns. B.L.R. guns have a right-handed rotation, that is, the projectile has a small constant *deviation* to the right on leaving the gun, which increases with the length of the range. This, as is shown in the 'Artillerist's Manual,' necessitates the tangent sights being placed at a certain inclination. "B.L.R. guns are sighted on both sides, the tangent sights being inclined to the left, at an angle of 2° 16′, to allow for the permanent deflection due to the rifling. The deflection scale, therefore, is only used to allow for wind or other causes of inaccuracy." M.L.R. guns have similar arrangements for meeting the deviation due to rifling, depending on the size of the permanent angle of deflection and that due to wind or other causes, such as one wheel being higher than another. "This deflection or *derivation* in rifled guns arises most probably from two causes: First, a shot rotating rapidly, and at the same time falling in the air, will experience a greater pressure underneath than above, and will, therefore, roll, as it were, on the denser air below; and if on leaving the piece it had a right-handed rotation, would roll to the right. Second, the resistance of the air on the point of an elongated shot fired with a right-handed rotation will act obliquely on the shot and cause deflection to the right."

**Dhall Bush** (*Cytisus cajan*) — The wood used in India in the preparation of charcoal for gunpowder. It grows in most parts of India, and has been found to make the best charcoal of the several woods at present known in that country. Colonel Anderson, in his work on the 'Manufacture of Gunpowder,' mentions it thus:—"Dhall bush has a growth of a few months: the seed is planted in April, and the grain ripens about the 1st January the next year, when the bushes are cut down. The stalks are brought in and stacked for use at the powder works. The wood is white and soft, and contains much saccharine matter. Hence, insects breed internally, while externally it is attacked by varions moths, which deposit their larvæ. The charcoal is good, its fibrous texture distinct, and it rings with a clear, metallic sound, being at the same time soft and friable. A beegah of urhur, another word for the dhall wood, is calculated to give about 200 maunds of wood in its yearly crop, or the charcoal for 160 barrels; hence 10,000 barrels would require a yearly cultivation of 60 beegahs."

As a general rule, the wood should be stripped of its bark previous to charring; this practice was not uniformly pursued in the Indian powder manufactories in former years, owing, it is supposed, to the expense, and, perhaps, the importance of peeling the wood not having been realised. The peeling process is now strictly carried out.

**Dhao**—A Burman tool or weapon (half chopper, half sword) used in clearing jungle and in cutting down trees of all kinds. The Burmese make great use of this cutting instrument.

**Dhurree**—An Indian term, for a coarse kind of cotton carpet, called also a *satringee;* it is used for the flooring of tents, and very generally for carpets in most houses in the North-West Provinces of India. This kind of cloth is made in different parts of the country, and very often by prisoners in gaols. A small satringee is issued by the commissariat department to every European soldier, which is placed on his sleeping cot in barracks, and in which his bedding is folded up on the march.

**Diabetes**—This complaint in horses, as explained in Small's 'Veterinary Tablet,' is brought on from "too strong diuretics, or bad hay. The symptoms are—increased flow of urine, great debility. The cure is rest and warm clothing, with a physic ball composed of Cape aloes, from 6 to 10 drams; Castile soap, 1 dram; spirits of wine, 1 dram; syrup to form the ball. Also an anodyne ball may be given, composed of opium, 1 dram; camphor, 2 drams; ginger powder, 1½ dram; treacle to form a ball."

**Diagonal**—A straight line which joins the vertices of two angles which are not adjacent to each other.

**Dial, Sun**—A plate of metal or stone on which the hours of the day are inscribed, in such a manner that the shadow cast from the gnomon erected upon it, which falls in a direction always opposite to that of the sun, shall indicate the apparent time. The gnomon represents the axis of the earth; hence its angle with the horizon is the latitude of the place, and it lies in the plane of the meridian. The hour lines are the projections of the horary meridians, given by the intersections of their planes with that of the horizon or dial. Dials may be placed either vertically or horizontally. The better class of dials have the equation of time for all the different periods of the year marked on the face.

**Diameter**—A line passing through the centre of a circle, bounded at each end by the circumference. When great accuracy is not required, the proportion of the diameter of a circle to the circumference may be taken as 1 to 3·1416. To find the diameter of a spherical shot, its weight being given, multiply the cube root of the shot's weight by 1·923 for the diameter. In taking the diameter or calibre of the bore of a rifled gun, it is measured across the *lands.*

**Diaphragm Shell**—A shrapnel shell. It is used with smooth-bore ordnance, and is an improvement on the original shrapnel shell; it is the invention of Colonel (now General) Boxer, R.A. It has a wrought-iron partition or diaphragm which separates the bursting charge from the bullets. The channel of communication, termed the loading hole, from the exterior of the shell to the powder chamber, into which the bursting charge is poured, is closed and opened by a small screw. The bursting charge in this shell is considerably reduced, and the interior of the shell is coated with marine glue, in order to ensure complete separation between the powder of the bursting charge and the coal-dust thrown between the bullets. The bursting of the shell is facilitated by four grooves formed in its interior surface which act as so many lines of "least resistance."

**Dickson's Guns**—These guns were designed by the late Sir A. Dickson, R.A.; they comprise some light 32-prs., 24-prs., and 18-prs. for naval service. They are now nearly all obsolete.

**Dies**—Are described as "tools used in cutting metal screws or bolts; they are the converse of the tap, as they must have internal instead of external threads, but the radial notches are essentially alike in each. For small works, the internal threads are made of fixed sizes, and in thin plates of steel; such are called 'screw plates.' For larger works, the internal cut upon the edges of two or three threads are detached pieces of steel, called 'dies.' These are fitted into grooves within 'die stocks,' and various other contrivances which admit of the approach of the screwed dies, so that they may be applied to the decreasing diameter of the screw, from its commencement to the completion."

**Dip**—In gun carriages the inclination or set of the arms of the axle-trees.

**Dip of the Needle**—In magnetism, as explained in Nuttall's 'Pronouncing Dictionary,' "is the inclination of the needle downward from a horizontal line." "The needle, which is magnetic, is supported and balanced on a horizontal axis, and playing therefore in a vertical plane. The angles through which it turns are indicated by a graduated circle, the centre of which coincides with the axis of the needle, and the frame which supports it has an azimuthal motion round a vertical axis, which is indicated and measured by the graduated horizontal circle."

**Direction**—In gunnery, is the path or course a projectile takes when fired from a gun. The path pursued may be either a *good* or *bad* direction, with reference to the points aimed at.

**Director of Artillery and Stores**—An officer appointed by the Secretary of State for War to assist the Controller-in-Chief. His duties are confined to all questions relating to the manufacture, provision, supply, and maintenance of munitions of war.

**Director of Supplies and Transport**—An officer appointed by the Secretary of State for War to assist the Controller-in-Chief. This officer has to deal with all questions relating to the provision and supply of food, forage, fuel and light, lodging and transport.

**Dirk, Highlander's**—A kind of dagger or poniard worn by Highland regiments. It is worn by officers rather for ornament than for use, though in former days it was a valuable weapon.

**Disarm, To**—The act of depriving a body of troops of arms for some gross misconduct or crime which renders dismissal from the service necessary. The Indian mutiny in 1857-58 affords instances of whole regiments being disarmed and disbanded. Other regiments, at the same time, apparently loyal, were simply disarmed, to prevent the chance of the men falling upon their officers.

**Disband, To**—In a military sense, is applied to the dismissal of a regiment, or any large body of men, from the conditions of their military service, for disaffection or treasonable conduct.

**Discharge, To**—Literally to shoot. The act of firing off a charge from a piece of ordnance or small-arm. Guns were formerly discharged by priming powder poured into the vent, or by quick match, which was ignited by means of slow match or portfire. Friction tubes have for some years past been introduced into the service, and have been found to be vastly superior in power and certainty of ignition to either of the above modes, and are now universally used. B.L. small-arms are discharged by means of a needle or piston coming in contact with detonating composition at the base of the cartridge.

**Discharge**—In the army, a release from military service either under compulsion or authority. There are several classes of discharge. First, on a soldier having completed the term of service for which he engaged, and not wishing to renew his services. This is either completion of limited engagement, or service for pension. Second, when permitted to purchase his discharge. Third, when disabled from wounds or sickness to serve any longer. Fourth, when discharged by sentence of court-martial to penal servitude. Fifth, when discharged with ignominy for some offence that brings dishonour on the corps. Sixth, when summarily discharged as a worthless and incorrigible character.

Each soldier on discharge receives a certificate stating under what circumstances he has left the army.

**Discipline**—As understood in military life, is the obedience to and exercise of all orders and regulations which have for their object the good government and management of a regiment or army. In fact, discipline may be defined as the perfection of order and regulation in an army. To it may be attributed in the day of battle much of the success which has attended the arms of a nation. Without it, an army becomes a rabble; and though bravery will do much towards achieving success, it is by discipline mainly that the object of a war can be ultimately attained.

Colonel Hamley, in his 'Operations of War,' gives the following explanation of the term "discipline:"—"It means cohesion of the units and suppleness of the mass; it means increased firmness and increased flexibility; it means the most efficient combination of many and various parts for a common end." "A hundred thousand soldiers," says Macaulay, "well disciplined and commanded, will keep down ten millions of ploughmen and artisans. A few regiments of household troops are sufficient to overawe all the discontented spirits of a large capital."

There is no greater instance of discipline than that recorded in Captain Duncan's 'History of the Royal Artillery,' when speaking of the deeds of the infantry at the battle of Waterloo. "As for the infantry, words cannot paint too highly their endurance on that long day. One regiment had 400 men killed or wounded before they were allowed to draw a trigger; and all suffered heavily. Yet there was not a word of distrust as regarded their great commander. They pined with all their hearts for permission to attack, instead of lying where they often were—being shot by scores; but discipline was stronger than desire. Given at the worst times, a word from the duke, or a report that he was coming, sufficed to produce a silence and a steadiness as perfect as if on parade in a barrack square. For those who were present, Waterloo was thus a double victory over their enemies and over themselves. True discipline is a succession of such victories."

The Mutiny Act and Articles of War form a code whereby the discipline of a regiment or army is kept up.

**Discretion**—As explained in James' 'Dictionary,' includes "prudence, wisdom, the liberty of acting at pleasure, uncontrolled and unconditional power; all which qualities, if wisely directed, will contribute much, in military affairs, to the successful termination of all undertakings."

The military phrase, *to surrender at discretion*, implies surrendering without stipulation, throwing one's self on the mercy of a victorious enemy.

**Disembarkation** — The removal of troops from a ship or railway train,* on their arrival at the place of disembarkation. It is the reverse of *embarkation*, and in the case of disembarking from a ship is performed with the aid of boats, flats, and rafts. The rate of disembarkation depends upon the size of the boats, and the number of men they will carry. In the boats attached to government transport vessels, such as the *Simoom*, 450 men can be landed at once, but such is not to be expected of the boats attached to hired transports.

Flats are valuable for disembarkation, as they are of little draft, have considerable buoyancy, great carrying power, are easy to steer, easy to stow away, and difficult to swamp.

For the disembarkation of artillery and cavalry, rafts are required, though there are certain difficulties attending their use, as they are difficult to stow away, and, if in pieces, time is lost in putting them together; further, they are difficult to steer (especially cask rafts) and awkward in bad weather. They are generally connected by coupling boats. Pontoons form the best rafts.

Boats for safety sake should not carry more than fifty men, and should be clear of all masts, spare oars, &c. The crew should consist of only six men, and the boats should be towed. In disembarking horses and guns, rafts should be used if the weather admits of it. In using rafts they should be connected by coupling boats. In the Crimea, Turkish store boats, which were flat-bottomed, were very good in still water. Their capacity was such as enabled them to carry two guns, two limbers, twelve horses and men. The French had special boats which they brought with them secured to the sides of their men-of-war.

---

* The term "embarkation" or "disembarkation" for troops by railway is recommended by Colonel Hamley, in his 'Staff College Exercises,' to be called *entrain* and *detrain*.

Besides boats, ships should have accommodation ladders, one on each side, in addition to what are termed sailors' ladders; if possible, passages for disembarking troops and cattle should be made from the main deck. In organising disembarkation, the same rules hold good as for embarkation.

If the expedition is a distant one, it is essential to have a rendezvous one or two days' sail from the actual disembarking point.

Before disembarking, a good spot should be selected, and this can be carried out under the reconnaissance of certain naval and military officers combined. What has to be looked for is

Good anchorage;
Deep water;
Beach for landing.

If combined with shelter from wind, so much the better. Opposition in landing will now-a-days depend on ships of war coming within range or not. If there are no ships of war present, the landing can be opposed by a very small force.

In making a reconnaissance before landing there are many other points to be attended to, which will occur to the naval authorities. But in a military point of view the following will have to be attended to, viz. that independent of a good landing it will be necessary to point out whether the place of disembarkation has a good supply of water; whether the roads lead inland; what are the names of the principal towns; whether there are facilities for forage, supply, or transport; and whether there is a suitable place for a depot at or near the landing.

The order of landing will depend upon the general, and the facilities afforded by the naval authorities for *carrying it out;* but not less than one division should be landed at a time.

In the Crimea 6400 men and twelve guns landed at one time.

If a fleet is properly equipped, one-third of a force should be put on shore at one time, not including cavalry, but including guns. Lastly should come the camp equipment and a small proportion of entrenching tools, the bulk of the stores being left on board under regimental escort.

**Disembody, To**—A term used in military parlance to signify the disarming of any body of men, or in dispensing with their military services for any stated period. The disembodying of the militia is an instance in point in the latter case, after they have been dismissed to their homes from permanent employment or embodiment in defence of the country.

**Disengage, To**—In machinery which is in motion, to lift a wheel *out of gear.*

**Disgraceful Conduct**—In the army implies conduct unbecoming an officer or soldier, and includes the following crimes:—

Fraudulently misapplying public money or stores;
Malingering and feigning disease;
Wilfully maiming or mutilating;
Maiming or injuring another soldier;
Tampering with eyes;
Stealing or feloniously receiving;
Offence of a felonious or fraudulent nature upon a civilian;
Indecent assault;
Producing false or fraudulent accounts or returns;

For each of which crimes an officer or soldier can be tried by a general court-martial.

**Dish of a Wheel**—The inclination or angle with the nave given to the spokes of a gun wheel, which in the N. P. field wheel is 2 inches.

The object of giving this "dish" is thus described by Captain Kemmis, R.A., in his paper on "The Principles of Construction of Wheels and Axletrees:"—"The most severe stress to which spokes are subject is from the lateral thrust brought to bear upon the nave when one wheel becomes lower than the other by slipping into a rut, &c. In order, therefore, to place them in a better position to resist this thrust, the wheel is 'dished' or formed into a kind of dome; and just as the dome or arch is strong, from its form, to resist pressure upon the crown tending to crush it in, so is the wheel made strong by the dish to resist the lateral thrust tending to force the nave outwards. In fact, not only do the spokes, sustained by the tire, yield mutual support to each other, but the lateral thrust upon each becomes partly converted into a compressing strain, which the wood has better power to resist. The greater the dish, the stronger the wheel will be to resist the lateral strain; but, for other reasons to be mentioned further on, no more dish should be given than necessary for the safety of the spokes." (*Vide* 'Royal Artillery Institution Papers,' vol. viii. No. 7, April 1874.)

**Disjunctor**—One of the three principal parts composing Navez' electro-ballistic apparatus. It is described as follows by Captain Noble, in the 'Royal Artillery Institution Papers,' vol. iii. page 117:—

"An important part of the apparatus (the disjunctor) remains yet to be mentioned. It will be obvious that the arc we have just supposed to be measured corresponds to the time which the projectile takes to pass over the distance between the screens, plus the time which the weight of the conjunctor takes to fall from its initial position to the cup of mercury. Now, to obtain the former, the latter of these times has to be subtracted from the reading of the instrument, and the disjunctor enables us to do this by permitting us to break both currents (those through the first and the second screens) simultaneously. The mode of procedure is then as follows: The instrument being arranged, the two currents are simultaneously broken by means of the disjunctor, and the reading of the needle is recorded. The instrument is again adjusted, and the projectile fired, the velocity of which it is desired to determine, and the reading of the needle again noted; the former arc is subtracted from the latter, and the corresponding time computed. It will be observed that, by the use of the conjunctor, any constant source of error (such, for example, as the *error due to the time* required to clamp the vernier needle) is eliminated, as the same error will occur both in the disjunctor and the projectile reading, and by subtraction will disappear. The disjunctor also enables us to ascertain the degree of regularity with which the instrument is working, as the accidental variations of the reading corresponding to the time are of course the same as the variations which would occur in the reading corresponding to any other time."

Major Navez lays down, as a rule, that observations should not be proceeded with when in a series of ten or twelve disjunctor readings there is between two successive readings a difference greater than 0° 25′.

**Dislodge, To**—In a military sense, to drive an enemy from the position he has taken up.

**Dismantle, To**—To render fortifications incapable of defence by razing them to the ground.

**Dismissal**—Is the sentence passed upon an officer by a court-martial, for conduct which renders him unfit to remain in the army. From the date of publishing the order, the dismissed officer's connection with the army ceases. It is in the power of her Majesty to dismiss any officer from the service without bringing him to trial.

**Dismount, To**—In artillery, to take a piece of ordnance off its carriage. With light guns, it is performed by the gun's crew with the aid of drag ropes. With heavy guns, gyns and jacks have to be resorted to; but guns of moderate weight can be dismounted by means of tackles, rollers, and handspikes.

*Dismount* is also a word of command given to all mounted men when ordered to alight from their horses.

**Dispart**—In gunnery, the dispart is generally defined as a patch of metal placed on the highest point of the muzzle of a gun or howitzer, and which is half the difference between the diameter of the base ring and that of the swell of the muzzle. This definition, as Major Owen remarks in his 'Lectures on Artillery,' will only strictly apply to cast-iron and bronze ordnance. He further explains that most of the *dispart sights* or *patches* are not placed near the muzzle, but on the top of the gun, a little in advance of the trunnions; or, as with rifled guns, just above the trunnions. A better definition for dispart would then be, half the difference between the diameter of those parts of the gun upon which the sights are placed. The term is derived from the mode of ascertaining the dispart, as shown above, and disparting (dividing in two) the difference between the two diameters, which *half* difference shows the tapering or coning of the metal between the base ring and swell of the muzzle. This patch of metal is intended, in laying the piece, to avoid the inconvenience arising from the line of sights or metal not being parallel to the axis of the gun. Disparts are either fixed or movable.

**Disperse, To**—In a military sense, is the power which an armed body, either better handled or in larger numbers, has of scattering a hostile force drawn up to oppose it. Cavalry, under these circumstances, forms a prominent part in pursuing or dispersing the enemy.

**Disposition**—In military language, as applied to the strategic position of troops, is of infinite consideration both in war and in time of peace. In the former case, a knowledge of the country in which the campaign is to be fought, and the various combinations which should be carried out, formed on the disposition of the troops, is very necessary on the part of the general in command, to bring matters to a successful termination, or to prevent the enemy from taking advantage of a bad disposition of his opponent's forces to harass or break them up. The following maxims from the memoirs of General Montecuculi are worth remembering:—

"Deliberate leisurely, execute promptly.

"Let the safety of your army be ever first.

"Leave nothing to chance.

"Take advantage of circumstances.

"Use all the means in your power to secure a good reputation."

**Distance**—The space between the observer and any object. In gunnery, *to judge distance* accurately is a high qualification in artillerymen, as well as in soldiers of the line, and is only to be attained by a clear sight, constant observation, and practice in the drill laid down on this subject, *termed "judging distance drill,"* the introduction of which into the army has been attended with such excellent results. Under the most favourable circumstances, however, judging distances by the eye is not to be depended upon, and this is so much felt in the artillery service that to each gun a range-finder will doubtless be attached, giving the distance of objects very accurately, and rendering it unnecessary to depend on the eye. Captain Nolan's range-finder for this purpose has been tried with good results.

In drill, *distance* is the relative space left between men in the ranks after a formation or movement; or the space between ranks closed or open.

**Distillation**—Is described as the separation of a body from extraneous substances by its conversion into vapour, its removal in that state, and its subsequent condensation. The operation is termed *distillation* if the vapour assumes the form of liquid upon condensation, even if that liquid should solidify upon further cooling. The vessels used for distilling are few and simple; those for raising the temperature of the water are generally of metal, and termed *stills*. A still consists of a boiler to contain the liquid, to which is adapted a head terminating in a beak, which fits into the condensing apparatus. There are several forms of condensers in general use—among them the *Worm* and *Liebig's* condensers.

**Districts, Military** — Represent the divisions of a country into separate military commands, which are so disposed that the troops shall be within easy hail of each other, and susceptible of being readily combined. Such is now the case in Great Britain, which is divided into twelve districts, and sub-divided into seventy sub-districts.

**Ditch**—The excavation or trench made round the works of a fortification, from which the earth necessary for the construction of the rampart and parapet is raised; the depth varies from 6 to 12 feet, in temporary works, but in a permanent fortification the depth will depend a good deal on the excavation which is required in building up the rampart. Ditches are either dry or wet. The former are preferred, as admitting of a better means of defence, but the latter are considered more secure against a surprise.

In the attack of a fortress the passage of the ditch is an operation which requires skill and management. The mode of effecting it is thus explained in the work entitled 'Instruction on Fortification, &c. at the Royal Military Academy, Woolwich:'—"When the ditch is dry, a passage across it is effected simply by means of a trench made by sap, extending from the opening of the gallery to the foot of the breach, the flank defences being subdued by the battery on the crest of the salient place of arms, assisted by musketry and vertical fire. After the breach has been made practicable, the fire of the breaching may be employed to drive the garrison from the summit of the breach, or to destroy a parapet, wall, or escarp gallery, should such exist on either side of the breach from whence the garrison might oppose the passage with musketry."

The mode of passing a wet ditch will depend on circumstances. When the water is stagnant, the difficulty will not be great. It is recommended in the above quoted work that a causeway made of fascines loaded with stones should be constructed. But if the water in the ditch be a running and swift stream, the difficulties to be overcome are almost insurmountable. The plan then is to find the head or source of the stream, and to divert it. An instance is given of this at the siege of Freiburg in 1713, where the waters of the Thersein, which flowed through the town, gave the besieged great command of water, and obstructed the passage of the ditch for some time with great loss, until the waters were diverted into another channel by the besiegers, when they crossed.

**Diving-bell** — A vessel inverted in water and let down to any depth by means of a rope, air occupying the upper part of the vessel. By means of the diving-bell, men are able to descend to great depths, and to carry on such submarine operations as may be necessary in masonry, laying stones, and the like, and of keeping under water for some hours by the aid of fresh air supplied by pipes or barrels attached to the bell.

**Division of an Army**—First unit of a *corps d'armée*, and commanded by a general officer. It consists of two or more brigades, composed of the three arms of the service. In the Crimea, each of the divisions of the British army was formed of two brigades, and each of the brigades consisted of three or four battalions.

**Division of Artillery**—A division of artillery, as now formed, consists of two or more brigades; a brigade, of two or more batteries. The system of *divisions* was introduced in 1809, and artillery massed in batteries, instead of being dispersed in battalions.

A division of a battery consists of two guns with their wagons..

**Dog Tire**—An instrument formerly used to draw the hot tire on a wheel. It consists of a bar of wood, about 2 inches square and 3 feet long. There is an iron catch with a turned-up end, about 9 inches long, which works either on a pin or an eye-bolt, let into the wooden stick. To use it, the end of the stick is placed under the felloes, and the iron catch over the tire, and the handle pressed downwards.

**Dog-wood** (*Cornus sanguinea*)—Wood from which charcoal is made in the royal gunpowder factory, Waltham Abbey, for R.F.G. and for R.F.G.$^2$ powder. It is not grown in any great abundance in England, and is therefore imported into the country from the continent. In private factories, the charcoals commonly used for all natures of powder are made from the alder (*Rhamnus frangula*) and willow.

**Dolphins**—Two handles or rings in the form of an extended horse-shoe formerly cast on the surface of ordnance, midway between the breech and muzzle. They were chiefly cast on bronze guns, and were found useful for lifting the gun out of its carriage.

**Donjon**, or **Dungeon** (Celtic *dun*, a height)—The highest and strongest tower of an ancient castle. It was sometimes the resort of the garrison when nearly worsted, in order to offer terms of capitulation; it was also used for the reception of prisoners.

**Donkey Engine**—A small steam engine, which is in very general use when stores have to be lifted. On board ship it is invaluable for filling or clearing the hold.

**Doolie**—An Indian term: a stretcher for carrying the sick and wounded in India. It is composed of a frame-work of wood, and the seat or flooring of cane or nawar (a coarse cotton tape). At each end of the doolie a triangular piece of wood is fastened to the frame, on the top of which there is an iron ring attached through which the bamboo for lifting the doolie is placed. The top of the doolie has a light framework of wood, over which a coarse red cloth curtain is hung to screen the sun and wind from the patient.

**Double Lever Bridge,** *vide* Spar Bridge.

**Double Sap**—In the attack of fortresses, is used for advancing directly to the front when the approaches cannot be advantageously made by zig-zags. (*Vide* Sap.) The double sap may be calculated to advance at the rate of 40 yards in 24 hours.

**Double Shell**—This nature of projectile has been introduced into the service for the use of certain R.M.L. guns, such as the 7-inch and 7-pr. M.T. gun, but for no other, though very good practice has been made with these shells from the 16-pr. field battery gun. The 7-inch double shell is nearly four calibres long, strengthened by three ribs internally, otherwise resembling the common shell. A bag is used to contain the bursting charge as given for common shell.

**Double-shotting**—As its name implies, is a doubling of the shot in the gun, whereby increased effect is expected. This was formerly a practice more often adopted in the navy than in land artillery. In the latter, double-shotting was only resorted to when the enemy being close on the guns, a double charge of case shot was likely to render good service. The introduction of rifled guns has done away with this mode of fire. What is now known as a "double shell" is nothing more than a shell of increased length and capacity.

**Dovetailing**—In carpentry, a method of fastening or joining two boards together by letting one piece into another in the form of the *tail of a dove, projecting* bits in one board being cut to fit into corresponding hollows in the other.

**Dowelling**—In carpentry, forms part of a joiner's work, and is the mode pursued by the joiner in joining planks or boards together; it is performed by inserting short pieces of hard wood, let in for half their length into a mortise cut in the edges of the boards that are to fit together, the mortises being, of course, made opposite each other, the dowels preventing the boards from rising up or starting from their places when the work is finished. Instead of short dowels, a strip, the whole length of the boards, is let into each joint, half the strip lying in a ploughed groove made in the middle of the corresponding edges of the two boards; but beside these precautions, the joints are well glued up. In making or repairing wheels, dowelling is resorted to by inserting or letting into the ends of each pair of felloes a round piece or pin of tough wood termed a "dowel," serving to prevent their deviation from the circle, when by pressure of the tire or any other force all the ends are compelled to meet. Dowelling is also applied in the manufacture of heads of barrels or casks.

**Dowlas**—A coarse kind of linen; it is used in a saltpetre refinery for filtering the saltpetre liquid as it is drawn off from the boilers.

**Drag Rope**—A rope having a small chain and hook attached to one end of it; it is used in the artillery service for pulling or drawing. Drag ropes are attached to all ordnance carriages, to assist in extricating them when in difficulty, in sandy soil, steep ascents, or in descents when there is no shoe attached to the carriage, or locking chain for holding upon the carriage. They are of two sizes, *heavy* and *light;* the former are issued to the 20-pr., 40-pr. B.L.R. and 16-pr. M.L.R. batteries; the latter to the 9-pr., 12-pr. B.L.R. and 9-pr. M.L.R. batteries. The chain end is intended to prevent the rope being cut by the tire of the wheel

**Drag Rope Knot,** or **Lever Hitch**—A knot the same as the men's harness hitch; it is used for fixing handspikes to the ropes attached to heavy carriages, which are to be moved by men; three men are attached to each handspike.

**Dragon**—A small kind of blunderbuss invented during the reign of Queen Elizabeth. It is thus described:—"A short hand gun, of great bore, to carry several pistol or carabine balls, or small slugs; and so called from the fact of its having a dragon's head at the muzzle."

This was the weapon with which the first regiments of cavalry were armed, and which gave to them the name of dragoons.

**Dragon's Blood**—A deep red resinous substance found in the East Indies, Cochin-China, and the Eastern islands. It occurs in masses of various degrees of purity, and in sticks, enveloped in palm leaves. Dragon's blood is employed as a colouring matter, and as an ingredient in varnishes. Formerly it was used in the browning liquid for gun barrels, but has been discontinued for some years past.

**Dragoons**—Soldiers trained originally to serve indifferently on foot or horse, and thereby enabled on an emergency to act as cavalry or infantry. Marshal Brissac, in 1600, appears to have raised this kind of horsemen. They were armed at first (in 1632) with a pike and musket; in 1645, with a dragon of musket bore, and in 1649 with a caliver. Subsequently the sword was substituted, and gradually dragoons ceased to act on foot.

The origin of the word dragoon is thus explained in 'Chambers's Encyclopædia:—"From the old fable that the dragon spouts fire, the head of the monster was worked upon the muzzle of a peculiar kind of short muskets which were first carried by the horsemen raised by Marshal Brissac in 1600. This circumstance led to their being called dragoons; and from the general adoption of the same weapon, though without the emblem in question, the term gradually extended itself till it became almost synonymous with horse-soldier."

The first regiment of British dragoons was raised in 1681, and called the Royal Regiment of Dragoons of Great Britain—now the *Scots Greys* or 2nd Dragoons.

In the British service there are three regiments of dragoons and seven regiments of dragoon guards; the latter are termed heavy cavalry.

**Draught**—In a military sense, any *given number of soldiers* taken from the different branches of the army, or from the different component parts of a regiment or brigade for any particular service.

**Draught**—The act of drawing or pulling carts or carriages by cattle or men.

This subject is of the highest importance in the artillery branch of the service, in which the whole transport of artillery *matériel* is dependent on draught cattle. Horses for this purpose form the chief draught, and none should be passed into the service under fifteen hands high, certainly not the wheel horses, for height tends very much to the capabilities of a draught horse, as explained in Hyde's 'Gunnery' on the subject of draught, in the following words:—"In four-footed animals, the hinder feet are the fulcrum of the lever by which their weight acts against the load; and when the animal pulls hard, it depresses its chest, and thus increases the lever; hence we see the benefit that may be derived from large horses, for their lever necessarily increases with their size. Large horses will draw more than small ones, even though they have less muscular force, and are unable to carry such a heavy burden. The force of the muscles tends only to make the horse carry forward continually his centre of gravity, or, in other words, the weight of the animal produces the draught, and the play and forces of the muscles serve to continue it."

In India, though horses form the draught of field artillery, heavy artillery, with the rest of the *matériel* of the army, is drawn or carried by elephants and bullocks.

**Draw the Charge**—To "draw the charge" is to remove the cartridge from the piece after it has been loaded or technically termed "sent home." In a gun this is generally effected by means of the "worm" attached to the rammer-head of sponge staves of light field guns. Heavy guns have each a wad-hook which consists of a wrought-iron socket, with a worm-head rivetted to a stave.

**Draw-bridge**—A bridge which can be drawn up so as to enable communication with the outside of the place to be cut off. In a fortified place, the communication with the country and between the various works is kept up by means of gateways, bridges, posterns, &c. Where bridges are used, they are always broken by drawbridges, which can be raised in a moment of emergency, and are usually drawn up every night by order of the governor of the place.

**Drawing, Military**—The representation or delineation on paper, by vertical or horizontal lines, of any portion of a country, the features and extent of which it is necessary a general in command of troops, serving in an enemy's country, should be made acquainted with. The best instruments for military sketching are the prismatic compass and pocket sextant.

The information which such a sketch would afford should be supplied by the Quartermaster-General's department, every officer of which ought to be able, with or without the aid of mathematical instruments, to delineate with facility and correctness a rough sketch of the peculiarities of the country.

**Drawing Paper**—For the different sizes, *vide* Paper.

**Draw-knot**—A knot in common use in the artillery service. It is used for the same purpose as the reef knot, viz. for joining two ropes together.

**Dress, To**—In drill or military manœuvres, is to keep a company, or battalion, in such a position or order as to enable it to make an exact continuity of any line or direction on which it may be formed. In dressing, the men turn their eyes to the *point d'appui*, where the officer is posted, and by his correcting the alignment on certain fixed points. the most perfect line may be obtained. In artillery, when a column is wheeled up into line, the dressing is made on the heads of the marker's horses, and 6 inches from them. In action, the dressing is on the axle-tree of the gun on which the formation is made. The same rule is to be observed in all formations of line, as well as in the correcting of a line, when it is necessary to throw out markers for that purpose.

In casting ordnance, *to dress* implies the removal *of the clay from the gun* when withdrawn from the pit, preparatory to turning.

**Dress, Military**—The clothing issued to soldiers, termed regimentals. The dress of the soldier should be light and easy, not encumbering his arms or legs in any way, but leaving him free to shoot and walk. The dress, moreover, should be adapted to the climate of the country in which the soldier serves. The earliest record of the government undertaking, for the first time, the clothing of English troops appears to have been in the reign of Edward III.

**Drift**—A gun implement made of steel; it is used for clearing the vent, when choked. In using it, a hammer must be applied to the head of the drift to drive it through the vent. There are also wood drifts, which are used in inserting the *papier-mâché* wad in common shell for rifled guns.

**Drift**—In gunnery, the deviation of projectiles from their true course. (*Vide* Deviation.)

**Drifts, Rocket**—Instruments used for driving the composition of signal rockets. They are made of wood pointed with brass ferrules; four are used in driving, three hollow and one solid; a fifth drift, with a rounded end, is also used to protect the choke, and to set the case in the mould.

**Drill**—The instruction given to all officers and soldiers of the army to fit them for their respective duties. It comprises the setting-up of the soldier, as well as the march and manœuvring of bodies of troops, equitation, the art of driving, and the working of guns, &c. Agreeably to the Queen's Regulations, "it is expected that every officer who has been two years in the service shall be capable of commanding and exercising a troop, battery, or company in every situation, and shall be perfectly acquainted with its interior management, economy, and discipline; and that every officer, who shall have been two years in command of a troop, battery, or company, shall be competent in every respect to undertake the duties of a field officer."

No officer is to be dismissed from drill until he has gone through a course of rifle instruction under the regimental instructor; and, in the cavalry, a course of single-stick, fencing, and army-signalling instruction.

Colonel Macdougall, in his 'Theory of War,' says that "The basis of all excellence in bringing an army into action is *drill.* No man can be a general without being perfectly master of the art of handling his troops of all arms."

**Drill Cartridge,** *vide* Cartridge.

**Drill Sergeant**—A name given to a non-commissioned officer, whose duty it is, under the orders of the adjutant, to attend to the drill instruction of young officers and soldiers.

**Drilling Machine**—A contrivance for giving rotatory motion to a drill, and, by means of spur gear connected with the arm, for moving the tool to and fro, or up and down. This machine is used for drilling holes in metal where accuracy is required, the rougher work being done by the punching machine.

**Drivers, Artillery**—Men attached to a battery of artillery to drive the horses. They do not work the guns, but, when they can be spared, are taught the gun drill. The men enlisted as drivers are of shorter stature than gunners, as height and weight are not required.

When men are enlisted as gunners, if they do not fulfil the conditions as to age and standard, they may be entertained as drivers, if likely to become good drivers, but special application must be made to the Adjutant-General.

In the early days of artillery both in the English and continental armies, regularly enlisted drivers were unknown. The horses attached to guns were driven by civilian drivers, who, we are told by Captain Hime, R.A., in his paper, "The Mobility of Field Artillery, Past and Present," were in the habit of running away on the first available opportunity, and in doing so at the battle of Falkirk lost our guns. But notwithstanding this catastrophe, it took half a century and upwards before matters in any way righted themselves, and even then. though a vast improvement had taken place upon the old system of dismounted civilians, great confusion in the organisation existed.

As further shown by Captain Hime, *the drivers* were enlisted in a corps *totally distinct from* the regiment, and commanded by their own officers; the drivers were thus separated by a wide gulf from the gunners; this want of connection between the field artillery and its means of draught led to discord, confusion, and waste of time. In 1817, the drivers were first placed under the command of the artillery officers, and in 1822 men were enlisted into the regiment as gunners and drivers.

**Driving**—In its usual sense, means the act of impelling or directing draught cattle; it is seen in the act of a driver urging or impelling his horses on. The term is also commonly used in the management of an engine attached to a railway train. In the laboratory, the word is applied to the mode formerly, and to some extent at the present day, of filling fuzes, port-fires, and rockets, with composition. The term is also used in mining, in constructing a gallery. And, lastly, the word is used to express the *driving side* of the grooves of a rifled gun, in contradistinction to the *loading side.*

**Driving Wheel**—In machinery, the wheel which communicates the motion to the pinion, or to the second wheel deriving its motion from the first, which may either be a multiplying or diminishing wheel according to the necessities of the case.

**Drooping**—In artillery, a term applied to the wearing away of the muzzle of S.B. guns, especially bronze guns, after long firing. Drooping occurs from the gun having much windage, and not alone from the cause hitherto given, viz. quick firing and consequent heating of the piece. This defect is not likely to happen to B.L. and M.L. rifled guns, as the former have no windage, the latter but very little; moreover, the barrel of rifled guns, being of steel, is not so liable to wear away as gun-metal. There is a method now of condensing the bores of bronze ordnance.

**Drug Carriage**—A truck carriage used for moving heavy guns in positions where the size of the platform would be inconvenient. There are several sizes of drugs. The largest is constructed to carry heavy guns of the present day, and is fitted with two pairs of frame shafts and outriggers for swingle-trees for four horses abreast. The small and medium drugs are fitted for man draught.

**Drum**—In machinery, the cylinder attached to the shaft over which the belting is placed, to communicate motion to the several wheels of the machine in connection with it. The term is also applied to all cylindrical articles of various manufacture having for their object the feeding of machines in particular positions.

The name is also given to a musical instrument, which consists of a cylindrical framework of wood, covered at the ends with parchment, and braced underneath with cords and snares. Drums are used by all infantry regiments, except rifle corps, to perform the beats at morning and evening in camp or garrison. They are not to be beaten after tattoo. In camp, in the performance of divine service, a drum (or drums) is often used as a reading desk.

**Drum, Beat of,** *vide* Beat of Drum.

**Drum-head Court-martial**—Though not mentioned by name in the Mutiny Act, or Articles of War, can be held on emergency in cases of mutinous conduct on the march necessitating instant punishment. Its powers are equal to those of a regimental court-martial, and its proceedings must be committed to paper.

**Drum-major** — A non-commissioned officer, whose duty consists in controlling the boys attached to a regiment, and in instructing them in the several "beats" of the drum. He marches past, baton in hand, at the head of his regiment in order to give the time to the band.

**Drummed-out**—A punishment formerly included in the award for dismisal from the service with ignominy. It consisted in the soldier being trumpeted or drummed out of the barracks or quarters of the corps to which he belonged.

**Drummer**—As his name implies, a beater of a drum, one whose duty is to beat the drum in military exercises. In regiments of the line, drummers, who are generally the sons of soldiers, and chiefly young boys, form a component part of the regiment, and are instructed in their duties by the drum-major.

**Drying Gunpowder**—In the concluding stage of the manufacture of gunpowder, drying is an essential *process. It takes* place after the powder has been glazed. Ordinary powder does not require the length of time or extent of heat to dry it as P. powder. This can be well understood from the size of the pebbles, and the amount of moisture in the latter when taken off the incorporating mills.

**Drying-room**—A room specially made in gunpowder factories for drying the powder. It is heated by steam pipes, and fitted with open frame-work shelves, on which small wooden trays, about 3 feet long, 1 foot 6 inches in breadth, and 2½ inches deep, are placed; the bottoms of the trays are covered with canvas or copper, and each tray holds about 12 lbs. of ordinary powder. The size of the room is in proportion to the outturn of the factory per diem, say, capable of holding from 20 to 40 or more barrels. Ordinary powder remains in the drying-room for 24 hours, P. powder longer, and is subjected to a greater heat; the heat is communicated by steam passing through pipes arranged horizontally on the floor of the room. (Some modification of this mode of applying the heat to P. powder has been made at the R. G. F. Waltham Abbey.) The temperature is raised and lowered gradually, otherwise the too sudden change would be likely to destroy the texture of the grain. The ceiling and roof are fitted with ventilators, through which all the moisture escapes; at the same time a constant current of hot air circulates through the room. It is of the greatest importance that the vapour should be carried off, for if this be not effectually done, on the decrease of the temperature it would condense, and form again on the powder.

**Dubber**—An Indian term; a vessel for holding oil. It is made of untanned ox or sheep skin, and is peculiar to Asiatic countries. It is also termed a *koopah.*

**Dubbing**—A mixture of certain oils and tallow which is applied in the treatment of leather, after it has been in use for some months, or after it has lain in store.

**Duffadar**—In the native Indian cavalry is a non-commissioned officer corresponding with the rank of a sergeant.

**Duffadar-major**—A rank in the Indian cavalry corresponding with the sergeant-major of a European regiment of cavalry.

**Dumb-bells**—Weights swung in the hands for exercise, and generally placed in the hands of military recruits while at drill, for the purpose of exercising the muscles. They weigh respectively 10 lbs., 16 lbs., and 20 lbs.

**Dummy Friction Tube**—A non-ignitible tube, which is used for drill prpposes. It consists of a steel prong, fork, and lanyard; the prong is entered in the fork, which is inserted in the vent and pulled through by the same motion which fires the service friction tube. Since the original pattern was approved of, it has been found that the prongs are liable to fracture the "eye." In the present pattern the prong is made stronger, and the split of the spring is carried through its neck, instead of the latter being solid.

**Dundas's Guns**—S.B. guns of somewhat similar form to those of Mr. Monk's, and introduced into the service, some years ago, by Colonel Dundas, R.A. They are not so conical, having a greater thickness of metal in the first and second reinforces. His 68-pr. (95 cwt.) is used both as a land and sea-service gun, and his 32-pr. of 58 cwt. has been largely used in the navy. There are other guns still in the service bearing his name, which are used for land or sea purposes.

**Dungeon,** *vide* Donjon.

**Dust, Powder**—All gunpowder, in the process of reeling, gives off a certain amount of dust. It is a great object to remove the dust from the powder, as it quickly absorbs moisture from the atmosphere, and, consequently, impairs its preserving qualities. This dust is not lost to the factory, but is worked over again, receiving first the process of incorporation for a short time, and then going through the rest of the mills until it becomes perfect gunpowder. The operation of dusting is effected by cylindrical reels covered with canvas, which revolve at a given rate.

**Duty**—In a military sense, the observa-ation and execution of all orders which pertain to a soldier. In carrying out the several duties which military service imposes, whether in a regiment or garrison, a roster is kept regulating the succession of duties. What is termed the tour of duty is invariably from the senior downwards. An officer on one duty cannot be ordered for any other, until he has completed the duty on which he is engaged.

*Garrison* and *brigade* duties are those performed by one regiment in common with another; regimental duties by the officers of a regiment or brigade of artillery among themselves. (*Vide* Queen's Regulations.)

With reference to a steam engine, *duty* is the amount of work done in relation to the quantity of fuel consumed.

**Dwarf Platform**—A wrought-iron frame, from which heavy guns are fired when in open batteries. The original pattern is similar in general construction to the "common traversing" platform, and guns mounted upon this nature of platform can fire through ordinary embrasures. By lengthening the legs of a platform of this kind, the gun could be fired over a parapet, if required. The ordinary garrison carriage is used with it, but has blocks instead of axle-trees upon which it rests, the part of the block between the cheeks being deeper, and passing between them, so as to keep the carriage in its place. In front of each bracket there is a pair of cheek plates, in which a gun-metal truck works, which comes into play when the rear of the carriage is hoisted up by the truck levers. The carriage is run up by means of tackles. Dwarf platforms were made to traverse on a pivot, but "raised racers" have been substituted, the platform resting on hollow solid trucks which run upon the racer. Since the introduction of heavy rifled artillery, a change of pattern has taken place, not only in this nature of platform, but in the carriage adapted to it, which is of the ordinary *single* or *double plate pattern*, both of which are made of wrought iron. Casemate carriages and platforms are similarly constructed, aud the platforms of each only differ in the height they are raised from the ground; the casemate platform being low for use in casemates, and the dwarf platform high for open batteries.

The present dwarf platform, as is shown in the 'Treatise on Military Carriages,' received its name of "dwarf," because, when introduced, the then service platform, now obsolete, was much higher.

**Dynamics**—That branch of mathematics which relates to the action of force producing motion.

**Dynamite**—An explosive substance, formed by mixing nitro-glycerine with a porous, infusorial earth, known in German as *Kieselguhr*. Its discovery is due to Mr. Nobel, a German engineer. The earth absorbs the oil, and the result is a plastic, putty-like substance of a brick-dust colour, containing about 75 per cent. of nitro-glycerine and 25 per cent. of absorbent earth. Dynamite is manufactured in England by the British Dynamite Company, who have erected extensive works at Ardeer, near Glasgow. There are two descriptions, No. 1 and No. 2; the former is of a stronger character than the latter. In the demolition of the fortifications of Marsal, in German Lorraine, both gunpowder and dynamite were used, and it is stated that the former was considered the most effective.

## E.

**Ear**—The name given to the lug or loop formerly cast on mortar shells. The term was also usually applied to the "dolphins" on light guns. The object originally of casting mortar shells with *ears* was, to assist in placing the shell in the mortar, but lewis holes are now adopted for that purpose.

**Earth, Moulding**—Used in casting. It consists of a mixture of clay, sand, and horse dung.

**Earthworks**—In fortification, all works thrown up for attack or defence in which earth enters chiefly into the construction.

In the defence of a place it is still an open question whether it would not be better to trust to earth than to masonry. The former is more ready at hand, easier repaired when penetrated by shot and shell, and the defenders are not so liable to be injured by splinters as by masonry. It is well known to readers of the Crimean War, and to the actors in it, what a difficult task the capture of the Mamelon was, on account of the ease with which the repairs were effected of a night.

**Ebony** (*Diospyros cardifolia*)—A tree common in the jungles of Southern India. It has a strong, hard, close- and even-grained wood, of a dark brown colour. A cubic foot of unseasoned wood weighs from 85 to 90 lbs. It is used in the Arsenal and Gun Carriage Agency at Bombay for drawer handles, press screws, &c.

**Eccentric**—Not in the centre. In gunnery, and when shell guns were in use, the term was chiefly applied to hollow projectiles the centre of gravity and centre of figure of which did not coincide.

**Echelon**—A step or round of a ladder. It is a formation laid down in the field exercise of the army, in which the divisions of a regiment are placed in a situation resembling, when viewed from a height, some analogy to the successive steps of a ladder, a circumstance which has caused the formation to be thus designated. The divisions are placed successively parallel to each other, but no two on the same alignment, each division having its front clear of that in advance, so that, by marching directly forward, it can form line with it. There are two kinds of échelon, the *direct* and *oblique*. The former is applicable to the attack and retreat; the latter for changing position, or for getting on the enemy's flank. The échelon formation is also applicable in many situations of batteries of artillery, and is particularly adapted to resist attacks in front or in flank. The direct échelon of artillery is formed by the successive march of subdivisions, divisions, or half-batteries to front or rear. The oblique échelon is formed by the wheel, less than the quarter circle of a battery, or any part of it, so as to be oblique to the former front, and parallel to each other. It is used to gain ground to a flank while moving to the front.

The échelon formation is found also to be very useful in the attack of cavalry against cavalry; it may be either in échelon from the right or left or échelon from the centre.

**Eclaireurs**—Literally, the feelers of an army. They are bodies, generally of light cavalry, sent to the front or the flank of an army to obtain intelligence as to the movements of the enemy. They are not used as exceptional or distinct bodies, but all the light cavalry is called upon to perform that duty. When the first Napoleon was Chief Consul of France, he raised a regiment of éclaireurs for the protection of Paris. In the continental war of 1870, éclaireurs were employed both by the Germans and French.

**Ecoutes** (French *écouter*, to listen)—Listening galleries. Such are known to engineers and others in connection with siege works. These galleries are run out under and beyond the glacis at regular distances in the direction of the besiegers' works, and enable the besieged to hear and estimate how near the besiegers have carried their mining operations.

**Education, Military**—A civil branch of the army, presided over by a director-general of military education, under whose orders are the military inspectors of schools. All officers who are candidates for the Staff College are examined under the orders of the director-general. The studies carried on at the college are regulated by him in concert with the commandant of that institution. The final examination of officers, who have passed the prescribed time at the college, takes place under his cognisance, and a report is submitted by him to the Horse Guards of the qualifications of the officers examined. His department supervises all regimental schools, garrison libraries, &c. In fact, on all subjects of education in the army he is the director and referee.

The following is a list of the government educational and scientific establishments in this country:—

The Department of Artillery Studies;
The School of Engineering at Chatham;
The School of Gunnery at Shoeburyness;
The School of Instruction at Aldershot;
*The School of Mus*ketry at Hythe;
The Army Medical School, Netley;
The Military School for Music at Hounslow;
The Royal Military Asylum at Chelsea;
The Royal Hibernian Military School, Dublin. (*Vide* Schools.)

**Effective**—Used, in a military sense, to denote the number of men actually borne and doing duty on the strength of a company or regiment, in the field or on parade.

**Effects**—The property of a deceased officer or soldier. On the death of either, a committee of adjustment is formed to take charge of the property, and to adjust the affairs of the deceased, as directed by the Mutiny Act.

**Efficient**—This term expresses a thoroughly trained soldier, and is also applicable to a well-trained volunteer. (*Vide* Volunteer.)

**Efflorescence**—The formation of small crystals on the surfaces of bodies, in consequence of the abstraction of water from them by the atmosphere. Saltpetre shows itself in this form on the surface of the ground.

**Elastic**—Any body which, being compressed, returns to its original shape on being released. The air, for instance, is an example of elasticity.

**Electric Fuze**—The invention of Mr. Abel, chemical examiner to the War Office. It is used for mining purposes, and is on the same principle as the electric tube, also invented by him. The electric tube can be fired by means of a magneto-electric apparatus or "magnetic exploder." (*Vide* Electric Tube.)

**Electric Light**—In 'Chambers's Encyclopædia' is found the following abridged description of this light:—"When the ends of two wires which form the poles of a powerful galvanic battery are made to touch, and then are separated for a short distance, the current, which passes when the contact is made, does not cease with the separation, but forces its way through the intervening air, accompanied with an intense evolution of light and heat. So great is the heat evolved that the most refractory metals are melted by it, and therefore some substance rivalling the metals in conducting power, but much more infusible, must be found to act as the poles, to allow of the continuation of the current in such circumstances. The various forms of carbon are well suited to this purpose; the more compact forms of charcoal answer very well; baked carbon answers better, but the cake that is sublimed inside the retorts in the distillation of gas, both for durability and conducting power, makes by far the best poles. Sir Humphrey Davy first discovered and described the electric light."

As this work does not admit of diagrams, a continuance of the explanation is herewith given. "The carbon points which are fixed into hollow brass rods opposite to each other, supported on glass pillars, are connected with the battery by wires entering at what are called the binding screws. The rods slide in the heads of the glass pillars, fixed to a stand, so as to admit of the points being placed at different distances. The wires from the battery poles being properly connected, the points are made to touch, and are then withdrawn a line or two, when the most dazzling light ensues, somewhat approaching the light of the sun in purity and splendour."

**Electric Telegraph**—As described in Francis' 'Dictionary of Arts and Sciences,' is a means of rapid communication by the science of electro-magnetism. It is known that when a current of electricity passes around a magnet, it occasions that magnet to diverge from its former position in proportion to the strength of the current. In the electric telegraph, a current is sent along a wire enclosed in a waxen or resinous material, to keep it dry and insulated from one station to another, where it acts upon several magnets, in accordance to a similar set of magnets at the first station. According to the manner in which it acts upon these, driving them to the right or left, more or less, it is instantly known what it is intended to communicate.

**Electric Tube**—The invention of Mr. Abel, chemical examiner to the War Office. This tube is used for firing guns at proof, and has superseded the galvanic tube for this purpose. It can be used for firing a large number of guns simultaneously; also for firing the time guns at large stations by means of an ordinary telegraph *wire from whatever* observatory the electric battery may be placed in. This tube can be fired by means of any electric agency, but is especially intended to be fired by means of an electro-magnetic apparatus, or "magnetic exploder." A fuze on the same principle as the tube is used with torpedoes, though a different composition is employed.

**Electricity**—Is described as "the science which treats of the laws of the electric fluid; a power which causes attraction and repulsion between light bodies. The following is the relative conducting power of metals:—

| | |
|---|---|
| "Copper .. .. | 10000 |
| Gold .. .. .. | 9360 |
| Silver .. .. .. | 7360 |
| Zinc .. .. .. | 2850 |
| Platinum .. .. | 1880 |
| Iron .. .. .. | 1580 |
| Tin .. .. .. | 1550 |
| Lead .. .. .. | 830 |
| Mercury .. .. | 345 |
| Potassium .. .. | 133 |

"The conducting power of rods of the same metal of equal diameter is inversely as their lengths; of rods of equal lengths, it is proportional to the mass, and not to the surface. The conducting power is increased by lowering the temperature, and diminished, and finally destroyed, by raising the temperature. Metals are infinitely better conductors than any other substances. Charcoal, which has been exposed to a strong heat, is one of the best conductors, but greatly inferior in this respect to iron or platinum."

**Electro-ballistic Apparatus**—An apparatus invented by Major Navez, of the Belgian artillery. It is thus described in the 'Royal Artillery Institution Papers': —"This instrument exhibits accurately the time occupied by a projectile in passing over different parts of the trajectory; also for measuring the force of gunpowder as it is actually used in every gun in the service. The electro-ballistic apparatus consists of a frame, across which thin copper wires are stretched horizontally in parallel lines, and of a pendulum, of which the vibration is measured. The frame is placed a few paces in front of the gun or the target, according as the initial or impact velocity is required. The wires, which are so close together that the projectile cannot pass between them, are connected with and act upon the pendulum, by means of an electrical current passing through them. Any one of these wires being broken by the passage of the shot, the pendulum indicates the force of its vibration, and by working out a mathematical formula, the velocity of the projectile is ascertained to the 1000th part of a foot per second."

**Elephant**—The most gigantic of existing quadrupeds. This animal is used as a beast of burden and draught in India, for carrying the camp equipage of troops, and for dragging heavy artillery. The elephant is of an average height of 8 or 9 feet, some grow to 11 feet; they carry from 1200 to 1400 lbs. and drag from 40 to 60 cwt. Elephants are found at the foot of the Kumaon Hills in the N.-W. Provinces of India, in Assam, in Upper Burmah, and in Ceylon. The elephant is also found in Africa, but does not appear to be such a high-class animal as the Indian elephant. Elephants are fed on wheaten cakes, coarse grass, and leaves. They breed in confinement, the period of gestation being about twenty months, and bring forth one young at a birth.

**Elevating Eye**—To facilitate the elevation and depression of the Armstrong land service guns, an *elevating eye* is screwed into the under side of the breech, at a suitable distance from the trunnions, for the adjustment of the gun, by means of an elevating screw; the 40-pr., however, has a somewhat different arrangement, having an elevating screw and quoin.

**Elevating Screw**—In a gun-carriage, the screw which elevates or depresses the gun. It is attached to light guns with wooden carriages by means of an eye and bolt, and the screw is known as the "ball and socket" pattern. The elevating screw attached to the new iron carriages is known as the Whitworth pattern. Heavy gun-carriages, such as the wrought-iron standing or rear chock carriages, have the "ratchet head and lever," with a modification in the chock carriages, which have an oscillating instead of a fixed nut.

**Elevating Sight**—The back sight of a gun or rifle which is raised, when it is found necessary, to elevate the piece.

**Elevation**—In gunnery, the raising of the axis of the piece sufficiently high to enable the shot to range the required distance. In firing at a given object, the axis of the gun must necessarily be directed upon a point at a sufficiently vertical distance above the object to allow for the action of gravity, which causes the ball continually to descend after leaving the bore of the piece. The elevation of the axis of a gun is generally regulated by means of a tangent scale, which is graduated in such a manner that the divisions on it correspond with the various ranges required from the gun.

In geometrical drawing, *elevation* is the projection of the face of a work on a vertical plane by horizontal rays. It shows the height or depth of a work, and also its length, when the plane of projection is parallel to its face.

**Ellipse**—In geometry, an oval figure formed of the section of a cone by a plane cutting both its sides, which plane, not being parallel to the base, meets the base of the cone when produced.

**Elongated Shot**—The name given to cylindrical or oblong shot, which are used with rifled ordnance. The shape of the head of elongated shot varies. The most appropriate pattern appears to be the ogival-headed shot, which is considered by artillerists the most penetrating.

**Embarkation**—The act of embarking a body of troops on board a "transport," when no troop-ship is available. This duty devolves on the Quartermaster-General's department. In taking up transports for the embarkation of troops, the following rules and regulations should be observed before calling for tenders. Calculate the tonnage required for each man and horse: for the former, from 2 to 3 tons; for the latter, from 6 to 10 tons. This, however, varies with length of journey. Having settled this, tenders should be called for. The inspection of the ships is next proceeded with by a board, consisting of an officer of the Quartermaster-General's department, a naval and a medical officer.

In choosing transports, steamers are preferable. For horses, paddle-steamers—screw-steamers being considered dangerous. Nothing under 30 feet beam for cavalry. Height between decks should not be less than

6 feet for men,
7 „ for horses.

Tonnage (sufficient superficial space) having been provided for the men, after deducting officers' cabins, hospitals, &c., space is then awarded for swinging the hammocks. The space required is known from the measurement of hammocks, each being

9 feet long,
6 „ for bed,
3 „ for clew,
18 inches wide.

The women and children require standing beds 6 feet by 3 feet.

Hospital for 3 per cent. of force.

After this preliminary inspection, the charter is drawn up. The fittings are the next things to be attended to, which are done in a government dockyard, or by contract under government, sometimes by the owners of the ship. It is the duty of the staff officer to see after these fittings. The meaning of the word *fittings* as applied to ships is given under that head.

Before the troops embark, a second inspection will take place under the Assistant Quartermaster-General, a military and a naval officer. A surgeon will attend. The embarkation of the troops will take place under the superintendence of a staff officer of the Quartermaster-General's department. Baggage should be on board the night before, and an officer or non-commissioned officer should arrange the messing.

When the troops are on board, they will be inspected by the general at the port.

Before sailing, a third inspection will take place by an officer not under the captain of the ship.

The above regulations apply to small forces in time of peace.

In large expeditions every transport should be numbered. Generally, the number of the regiment is marked on the bows or sides of the *ship*.

Transports are grouped in divisions corresponding to army divisions.

If the place of embarkation should be an open beach, it should be marked with posts, named and numbered, and the more numerous the better, not less than 200 yards apart.

On an open beach, stages should be run out; in still water, floating piers.

Regiments should be detailed by the Quartermaster-General. Orders cannot be too minute. A staff officer should be named, and the hour stated at which regiments are to be drawn up, as well as the hour for the reception of the horses, baggage, and men.

Each regiment should be complete in each ship, taking its amount of ammunition and camp equipage.

Infantry transport animals cannot always accompany regiments.

Drill should be practised for embarking in boats, the boats being end on.

The slings of rifles should be loose, and the rifle of each soldier in his left hand, the knapsack being on the left shoulder. The march on board the boat should be in single file. In getting out of the boat, the rifle should be slung over the left shoulder, and the knapsack over the right.

The following regulations for the maintenance of order and discipline on board her Majesty's ships in which land forces are embarked as passengers, cancelling those approved by her Majesty on the 22nd of February 1870, have been sanctioned by the Queen, in accordance with sect. 88 of an act of parliament, entitled "An Act to make Provisions for the Discipline of the Navy," passed in the 29th year of her Majesty's reign:—

"1. Whenever any of her Majesty's land forces, or any royal marines formed into a separate corps or battalion, shall be embarked as passengers in any of her Majesty's ships, the officers and soldiers shall from the time of embarkation strictly observe the laws and regulations established for the government and discipline of her Majesty's navy, and shall for these purposes be under the command of the senior officer of the ship, as well as of the superior officer of the squadron, if any, to which such ship may belong.

"2. If any officer or soldier shall commit any act against the good order and discipline of the ship in which he is embarked, the commanding officer of the ship may, by his own authority and without reference to any other person, cause him to be put under arrest or to be confined as a close prisoner, and shall thereupon, if he thinks the case requires it, transmit a report in writing of the charges against such officer or soldier to his superior officer, or if there be no senior officer present, to the commanding-in-chief of land forces, in order that the offender may be brought before a military court-martial.

"3. If any officer or soldier commits any act which, in the opinion of the commanding officer of the troops, requires a trial by court-martial, such commanding officer shall, with the concurrence of the captain of the ship, cause him to be disembarked on the first opportunity, or to be removed to a transport ship, and be there proceeded against according to military law. No military court-martial shall be held on board any of her Majesty's ships in commission.

"4. If any private soldier shall commit any act against the good order and discipline of the ship, the commanding officer of the ship, if he thinks the case requires the infliction of any summary punishment for which, by the regulations of her Majesty's navy, a warrant is necessary, shall apply for the concurrence, in writing, of the commanding officer of troops, as to the nature and amount of such punishment, if any, to be inflicted, and upon obtaining such concurrence in writing shall, by warrant under his hand, sentence the offender to suffer such punishment accordingly. The sentence shall in all respects conform to the provisions contained in the Naval Discipline Act, 1866, relating to summary punishments awarded by commanding officers. If the commanding officer of the troops shall decline to give his concurrence as aforesaid, he shall state his reasons in writing and deliver the same to the commanding officer of the ship.

"5. The commanding officer of the troops, upon receiving a notification in writing to that effect from the commanding officer of the ship, may, in respect of *minor offences* committed by any of the troops on board, award such summary punishments as are permitted by the regulations of her Majesty's navy to be awarded without a warrant."

These regulations have met with the concurrence of the Field Marshal Commanding-in-Chief and the Secretary of State for War.

**Embarking Artillery**—The following directions, taken from the 'Artillery Instructions,' will be found applicable to nearly all the cases likely to occur, such as embarking or disembarking from a beach, from a wharf, with or without boats, in presence of an enemy, &c. &c. "On the arrival of a battery at the place of embarkation, it is to draw up in as compact order as is consistent with the performance of the operations required. The horses are to be taken out, the harness taken off and packed in vats, and the stores in cases. When there are no vats and cases, the stores must be secured to the carriages or tied together; the intrenching tools may remain with the carriages. The non-commissioned officers in charge of sub-divisions will attach to their harness and stores pieces of basil, having the number of their subdivisions written upon them. The harness for each carriage should be embarked with it. The gun detachments will prepare the carriages for embarkation. They will take off the side arms and secure them together, take out the elevating screws, unkey the cap squares, unlash the ammunition boxes, and coil up the lashing ropes. Each carriage, when called for, is to be run forward to the boat or crane; the gun is to be unlimbered and dismounted; the ammunition boxes, shafts, wheels, &c. to be taken off; the washers and linch-pins must be carefully put away in the slow-match box, and in the small box between the limber boxes. Every article must be stowed away with the greatest care, and arranged so as to be got at without delay. Those articles which will be the last required when disembarking are the first to be embarked. The divisions, and everything belonging to them, should be kept together as much as possible. The first to be embarked are the spare carriages and forge, which are to be stowed forward; the left division next to them, and before the main hatchway; the centre abaft the hatchway; the right under the hatchway. The whole of the guns are put together, generally in the bottom of the hold, vents turned downwards, and a fid in them, to prevent their being choked. When a battery is embarked in different vessels, every part should be complete, and a proportion of general stores be on board of each. If the voyage is likely to last some days, cartouches with the ammunition must be taken out of the boxes and stowed in the magazine. The ammunition must be so placed that whatever part belongs to any particular carriage may be got at without difficulty. When the cartouches are not taken out, the boxes must be stowed well aft in the hold, or between decks, and they should be carefully covered with wadmill tilts or haircloths. In embarking from a beach, it may be necessary to erect small sheers made of a couple of topgallant masts, previously prepared for the purpose. In embarking from a wharf, if there are cranes, they should be made use of. If boats are employed, the loads must be regulated by the state of the weather and distance of the vessels.

"*Embarking the Horses.*—When the vessels can come alongside a wharf, the horses are hoisted in by means of tackle. The slings, made of canvas, should be minutely inspected, to see that they are secure. There must be a double guy made fast to the horse's head, one end on shore, the other on board to keep his head steady. A shoeing-smith should be in each ship to receive the horses. A horse requires at least four men besides the driver to sling him, one on each side, one at his breast, and one behind. One end of the sling is passed under his belly, and both ends made to meet over his back; one man passes his loop through the other; it is received by the man on the other side who hauls it through, hooking the tackle through it, both men holding up the ends of the sling. The men at the breast and behind bring their ropes round, and make them fast to the grummets. The driver holds the horse's head and makes fast the guys to it. The horse being previously blindfolded, the word "Hoist away" is given, and he is hoisted on board. The slings are then taken off, and he is led to his place, the first horse being always placed forward or aft, as the ship fills, the stalls nearest the hatchway being reserved for the horses which are to be first landed. The horses are to be embarked in the same order as the carriages, care being taken that the officers' and non-commissioned officers' horses are on board with the divisions to which they belong. The farriers and shoeing smiths should be distributed in different ships. When horses are embarked in boats, sheers, or a derrick, are necessary. The head of the derrick must incline inwards when the horse is rising, but when he is high enough, the head of the derrick or sheers most be forced out, to bring the horse over the boat. This applies to beach or wharf. Sand or straw should be laid in the boats to prevent the horses slipping. They should stand athwart, the head of one horse being on the starboard, and the head of the next on the port side. The drivers sit on the gunwale, or stand between the horses. When horses are embarked from an open beach, without any appliances, they are to be led to the boat, and the halter given to one of the men in it. The horse must then be made to walk or leap into it, the gunwale of the boat being inclined towards the shore. A quiet horse should first be embarked, and the others will more readily follow. In embarking in presence of an enemy, the horses and carriages should first be embarked, the guns being retained to the last, to repel any attack. If the position be a mile or two from the place of embarkation, it may be necessary to retain a portion of the horses."

"*Disembarking.*—The disembarkation is the reverse of what has been detailed. The harness is the first thing sent on shore. If the water is smooth, with little surf, the disembarkation may be easily carried on upon the beach, and the horses made to leap out of the boats. In disembarking in presence of an enemy, the guns should be put into boats, mounted; launches of men-of-war being best adapted for this purpose. The muzzle of the gun must point forward in the boat; and as soon as the boat takes the ground, the gangboards are put out, and the gun run ashore. The limber should accompany the gun."

**Embrasure**—An opening cut in the parapet in order to enable the artillery to fire through, and to command a certain extent of the surrounding country. The space between every two of these openings, called the *merlon*, is from 15 to 18 feet in length. The form of an embrasure is that of a prism, its base being a trapezium. The opening of the embrasure is termed the *neck*, and is 2 feet wide; that towards the country, the *mouth*, which is usually made equal to half the thickness of the parapet; the other parts are termed the *sides*, the *cheeks*, the *base*, and the *sole;* the slope is generally less than the inclination given to the superior slope of the parapet, in order that the fire from the embrasure may meet that of the musketry from the parapet, at a point within a few feet from the top of the counterscarp. In casemates, iron shields (*q. v.*) are provided for the openings of embrasures.

The value of embrasures is very questionable, and with the opinion now prevailing as to their use, it is not unlikely that they will be, if not altogether, to a great extent, done away with in future fortifications. The feeling of the gunner is strongly against them, because he cannot always see through them in the right direction, because they make a mark for the enemy's fire, and because they admit some of the adversary's projectiles.

Then, again, embrasures weaken a work and draw a stronger fire upon them than other portions of a parapet, the result of which is constant dilapidation and constant repair, thereby subjecting the men in the battery to great exposure. It has been remarked that, "if we look back to the Crimea, and think over the numbers of gallant fellows we saw slain in and around the embrasures of our batteries, it induces us to ponder much, to wonder how it happens that this curse of the siege is even to this day permitted to intrude itself in our batteries." The remedy has been shown, and which lies *in the* use of an elevating or elevated *carriage for the gun*; such, in the former case, as the Moncrieff carriage, or in the latter after the manner of the Prussians at Paris in 1870–71, who mounted their guns for bombarding purposes on high carriages, and, firing just clear of the crests of their batteries, dispensed entirely with the use of embrasures.

**Emery**—An opaque variety of the mineral alumina, containing a considerable proportion of iron. It is ground into different degrees of fineness, and used in arsenal workshops for polishing and scraping off the outer coating of gun barrels before being re-browned, also for removing rust from the interior of gun barrels, but this is prohibited in cleaning the barrels of rifled small-arms.

**Eminence**—A high or rising ground overlooking and commanding the surrounding country.

**Emissary**—A spy, a scout. In a military sense, one who during war time personates the dress, language, and character of the power or nation he is sent amongst for the purpose of obtaining information, or for the purpose of creating disaffection in the ranks of the enemy.

**Encampment**—The ground taken up by any force on the conclusion of its march. The nature of the camp formed, whether of huts, tents, or bivouacs, must depend on circumstances, such as the proximity or otherwise of the enemy, the facility of procuring carriage, &c. In the former case, bivouacs form the simplest mode of resting, and are accompanied with least trouble. Huts would be only erected for a standing camp, when an army occupies a defensive position for a long time, or during a siege; they are rarely made during a campaign. In the formation of an encampment, care should be taken, in selecting the ground, that it is not commanded, cannot be turned, and that, as far as possible, as shown in the regulations and instructions on the subject, it commands and surrounds the neighbouring positions. It is to be borne in mind that it is not necessary for each division to encamp on its line of march; it may with great advantage be placed at a short distance on either side of that line. By bearing this in mind, a larger number of sites to choose from may be obtained. Then again it is not to be forgotten that the site for a *standing* camp is selected chiefly because it presents certain strategical advantages, and that for a *flying* camp on account of some tactical advantages the ground offers.

Not only has the site of an encampment to be viewed from one point, viz. in its *military* aspect, but also from a *sanitary* point; and this must be observed with every encampment, whether of a division, of a picket, or of an outpost. The movements or position of the enemy must of course decide whether military or sanitary reasons shall weigh most. There are many other points to be attended to besides those which have been enumerated, viz. the facilities which the site selected offers for obtaining water, wood, forage, and straw. The site should also be, if possible, on a sandy or gravelly soil, and very dry. The ground, as a rule, should slope to the south or east.

**Enceinte**—In fortification, the body of the place, which is enclosed by bastions and curtains.

**Encounter**—Literally, a combat or fight between two persons. It is not unfrequently used to describe a battle or attack by large or small bodies of troops.

**Endless**—In machinery, is described as "the cord or band by which wheels and axles are made to act on each other. Sometimes the cord is placed in a groove in the circumference of the axle, and carried round a similar groove in the circumference of the wheel; this is termed an endless cord or band, by which wheels are driven either in the same or in an opposite direction. The term is also applied to an endless or perpetual screw. This method of transmitting the motion from wheel to wheel is presented in every department of the arts and manufactures. One of the chief advantages of this method of transmitting motion by wheels and axles is, that the bands by which the motion is conveyed may be placed at any distance from each other, and even in any position with respect to each other, and may, by a slight adjustment, receive the motion in either one direction or the other."

**Enemy**—In a *military or national* sense, signifies any nation or power with whom another is at war; it includes also the allies of that power or nation.

**Energy**—A term in artillery to express the amount of "stored-up work" in a projectile when it strikes an object. It is calculated thus:—

$$\text{“}\,\frac{w\,v^2}{2\,g} = \left\{\begin{array}{l}\text{energy in}\\ \text{foot-pounds;}\end{array}\right.$$

where $w$ = weight of shot in pounds;
$v$ = remaining velocity in feet per second,
$g$ = accelerating force of gravity.

Suppose, for example, a shot from a 35-ton gun of 700 lbs. weight to be travelling at the rate of 1000 feet per second, what would be the energy? Here we should have 700 multiplied by the square of 1000, or 1,000,000, and divided by twice 32·2, or 64·4. The answer to this is 10,869,563 pounds.

"As the result given thus in pounds is inconvenient, owing to the number of figures it contains, it is usual to represent it in tons, and as there are 2240 lbs. in a ton, we must divide the above number by these figures. Thus, 10,869,563 divided by 2240 equals in round numbers 4853 tons or 'foot-tons.' This signifies that a 700-lb. shot striking with a velocity of 1000 feet would, before it was brought to rest, or had its 'life' destroyed, expend 'work' sufficient to raise 4853 tons 1 foot from the ground."

It is found that the power of piercing unbacked armour-plates decreases as the diameter increases, and therefore energy is generally expressed in foot-tons per inch of circumference of the projectile, &c. (*Vide* Appendix B.)

**Enfield Rifle**—This arm was at one time in use in the British army. It takes its name from the small-arm factory at Enfield, a government establishment for the manufacture and supply of small-arms of every description to the army. It was originally a muzzle-loading arm, but was subsequently converted into a breech-loader; it is now known as the Snider-Enfield: there are two patterns, that of 1853, having 3 grooves, and that of 1860, 5 grooves.

The length of the barrel of the pattern musket of 1853 is 54 inches without the bayonet; having one spiral turn in 78 inches. Weight with bayonet, 9 lbs. 12 oz.

The short rifle musket pattern (1860) is 48¾ inches in length without the bayonet, having one spiral turn in 78 inches. Weight with bayonet, 10 lbs. 4½ oz.

Some of the native regiments in India are armed with the Enfield rifle, and some with the Snider-Enfield.

**Enfilade Fire**—Sweeping the whole length of any work or line of troops by a fire from musketry, or a battery placed perpendicularly to the prolongation of the crest of a parapet, or to a line of troops, the guns being fired with full service charges.

**Engagement**—In a military sense, signifies a conflict, action, or battle between two contending armies.

**Engine**—Denotes, generally, a kind of machine in which two or more of the simple mechanical powers are combined together.

**Engine, Condensing,** *vide* Condensing Engine.

**Engine, Fuze**—A name formerly given to an instrument for extracting a wood fuze when fixed in a spherical shell. As it was found faulty in construction, it has been replaced by the present fuze extractor, which is applicable to extracting wood fuzes from rifled shells.

**Engine, Steam,** *vide* Steam Engine.

**Engine, Water**—A machine for throwing water to heights and distances, by means of a force-pump, and pressure from air condensed in a chamber. It is used in standing camps and barracks for extinguishing fires. (*Vide* Fire Engine.)

**Engineers**—One of the branches of the army, to which is entrusted, in times of peace, the erection of all military buildings, and during the operations of an army in the field the construction of every description of fortified works, also the planning and direction of the attack and defence of a fortification. Indeed, the duties of this branch are so multifarious that it is scarcely possible to define them. On active service, an engineer officer is sometimes a sapper officer; at another time he is found engaged in the construction of works and bridges; or he may be employed in the reconnoissance of a country, or attached to a general officer as engineer of the division of an army. The duties of the engineers, both at home and abroad, are detailed in the 'Aide-Mémoire to the Military Sciences.'

Before the peace of 1763, the duties of engineers were performed by officers of the army generally; very shortly afterwards they were made into a permanent corps, and in 1783 were raised to be a royal corps. In 1812, the sappers and miners were organised. Until 1859, the non-commissioned officers and men were called *Sappers and Miners*, but this designation was then abolished, and they became Royal Engineers. In 1861 the Indian engineers were amalgamated with the royal engineers, and became one regiment, the promotion being carried on in their several cadres. The *personnel* of the regiment consists of 17 battalions—8 for imperial service and 9 for Indian. In each of the imperial grades, there are the following numbers of officers:—General officers, 19; colonels, 22; lieutenant-colonels, 53; majors, 79; captains, 121; lieutenants, 179. The old cadres of the late Indian engineers are gradually dying out.

The mode of officering this corps is through the Military Academy at Woolwich. For the rules of admission to the academy, *vide* Appendix A.

Besides military engineers, civil engineers have been of late years entertained by her Majesty's Indian government, to supplement the establishment of the royal engineers in India. A college is now established at Cooper's Hill by the government of India for the education of civil engineers for its own service.

**En l'air** (French)—Literally, in the air, unsupported. It is said that a division is *en l'air* when it is unsupported or too far from the army either to render assistance or to receive support. For instance, at the beginning of the war of 1870–71, General Douai was at Belfort, MacMahon in the east of the Vosges, De Failly, *en l'air*, between Frossard and the Duke of Magenta.

**Enlargement of the Vent**—Caused by rapid and constant firing and erosion. When it becomes considerable, the vent is rebouched. In old iron ordnance, which had not copper vents, the gun was condemned if the hole was enlarged to 2 inches. (*Vide* Erosion.)

**Enlist, To**—Literally, to enter a name on a list. To engage in military service by subscribing articles, or enrolling one's name, before a magistrate, as a soldier. To receive any current coin of the realm as enlisting money, knowing it to be such, from any person employed on the recruiting service; hence the term "to take the shilling." The mode of enlisting formerly pursued, in which the recruit received a bounty, has been abolished, and he no longer receives a bounty, but agrees verbally with the recruiting sergeant to serve as a soldier. Subsequently his agreement is reduced to writing before a magistrate, who attests or swears the soldier to perform military service. (*Vide* Appendix I.)

Enlistment in the British army (unlike what it is in continental armies where the conscription or compulsory service is in force) is a voluntary engagement to serve her Majesty at home or abroad. There are many arguments for and against both systems of enlistment. Generally, military opinions are for compulsory service; civil and economic, for voluntary. The army gains by the compulsory system, having reference, among other arguments, to the certain and ready mode of enlisting; but the country suffers, in consequence of loss of valuable labour to the country. England, therefore, will not adopt this system unless it can be proved that a sufficient army cannot be raised without it. This is the true point on which the question turns in this country. With reference to enlistment in continental armies, see the articles on the several foreign armies.

**Ensign**—Formerly, the name and rank given in the British army to the junior grade of commissioned officer in a regiment of infantry. This name has been abolished in the regiments of the line, and in the militia, since 1871, and sub-lieutenant substituted for it. The name "ensign" is derived from the circumstance of an officer of that rank being told off to carry the colours.

The name is also applied to a standard, banner, or flag. The *ensign* of the British navy is the St. George's, a *white ensign*, with a red cross, and the union jack in the left hand upper quarter. The English ensign is a red, white, or blue flag. having the union jack in the upper corner next the mast.

**Entanglement** — A kind of abatis formed of trees, with the trunks cut half through. It forms a very serious obstacle to the advance of an assailant. A good entanglement can be made with stakes and wire. The mode will suggest itself without any further explanation.

**Entrepot**—An intermediate depot for the reception of stores and arms in a garrison town where there is no arsenal or magazine.

**Environ, To**—To enclose in a hostile manner; to hem in; to besiege.

**Epaulettes**—Shoulder ornaments worn by military and naval men to distinguish their rank. They were done away with in the British army in 1855, but are worn in the navy, in the corps of gentlemen-at-arms, and by deputy lieutenants. Epaulettes are still worn in several continental armies.

Epaulettes appear to have come into fashion in 1784, being worn first of all by dragoon regiments. Subsequently, the infantry wore them: a field officer, two epaulettes; a captain, one on the right shoulder; and a subaltern, one on the left shoulder. Later on, officers of all ranks wore epaulettes, generally on both shoulders.

**Epaulment** (French, *épaule*)—A parapet on the flank of a battery, serving to protect the guns and gunners from the fire of the enemy. Any accident of ground from behind wherewith troops can protect themselves is an epaulment. Epaulments are generally made of filled gabions or fascines. It is stated that epaulments, two lines, were considerably used by the French at Gravelotte.

**Eprouvette, Vertical** — An apparatus for testing the strength of gunpowder after it has been incorporated. It consists of a small mortar in which a ball, attached to a rod, is placed. The mortar rests in a vertical position, and is fixed in a wooden bed. The rod, with the ball, weighs 28½ lbs., and the rod is graduated to feet and inches. On the charge (which consists of only half a drachm) being fired, the ball, with rod attached, is projected upwards as far as the force of the powder will carry it; it is prevented from descending by a small pawl which catches in a rack on the surface of the rod. The height to which the rod ascends shows the strength of the powder.

**Equation**—In mathematics, is the name given to the symbolical expression of the equality of two quantities, and generally containing at least one unknown quantity. Thus, $x - 3 = 4$ is an equation which states the equality between $x - 3$ and 4, in which $x$ is the unkown quantity. A quantity is *known* when its value in numbers is given, and when this value is not given, it is called an *unknown* quantity.

**Equation of Time**—Is thus described by Milner:—"It has been observed that the intervals between two successive arrivals of the sun on the meridian are not the same at all times of the year, but sometimes greater and sometimes less than 24 hours, as shown by a well-regulated clock. Hence the distinction between apparent or solar time shown by the sun-dial, and true, or mean, or equinoctial time given by a clock, adjusted by an imaginary sun supposed to move in the plane of the equator, with an equable mean motion. The difference between them, which sometimes amounts to 16¼ minutes, is called the *equation of time*."

**Equerry**—At the British court, a subordinate officer under the master of the horse, usually a military man. There is a chief equerry, also four equerries in ordinary, and an equerry of the crown stables. Each member of the royal family has one or more equerries.

**Equipage**—Implies everything needful for a regiment or army to be supplied with on the march or operations in the field.

**Equipage, Camp**, *vide* Camp Equipage.

**Equipment**—Signifies the arms and accoutrements and all such articles as are worn or carried by the soldier; they are supplied by certain departments charged with their administration. In the artillery service, the term *equipment* includes the ordnance and carriages, the supply of ammunition and stores. In the cavalry, all articles of saddlery, and such as the horse carries, are included under this head.

**Equitation**—The art of riding. Military equitation, the principles of which are the same for all classes of cavalry—a uniform system existing throughout the country—is described as consisting "in the skilful and ready application of the aids with which the rider guides and controls his horse in all his paces, and in a settled balance of the body, which enables him to preserve a firm seat in every variety of movement. The aids in horsemanship are the motions and proper application of the bridle-hand and legs, to direct and determine the turnings and paces of the horse. Military equitation may be divided into three parts:—

"1st.—The complete instruction of the recruit upon a trained horse, from the earliest to the last lessons.

"2nd.—The training of the horse by skilful and experienced men.

"3rd.—The practice of the recruit and remount horse at close files in the elementary parts of field exercise, to prepare them for instruction in the troop or squadron. This science is indispensably requisite for the military horseman, in order that, being able to govern his horse by the aid of his legs and bridle-hand, he may have the right hand at full liberty for the use of his weapon, and be capable on all occasions, whether acting singly or in squadron, of performing his various duties with care. With this view, both men and horses should be constantly practised in the exercise of such lessons as will enable them either to move in a compact body or to act singly or independently."

The system of equitation now taught is that practised at the riding establishment at Canterbury; and with the view of maintaining one system throughout the conntry, commanding officers of regiments are called upon from time to time to select non-commissioned officers and soldiers, and to send them to the riding depot at Canterbury, for the purpose, as stated in the Queen's Regulations, of being practised in the equitation exercises, and trained as riding instructors in their corps.

**Erosion**—The act of eating away. As applied to guns, it is the guttering or scoring observed at the seat or vent of the gun after much firing, and is caused from the action of the inflamed gunpowder upon the metal, as it passes between the upper surface of the shot and the gun. It will probably be found that the sulphur is the eroding part of the gunpowder, from its affinity for iron in its heated state, forming sulphide of iron. To check the destructive escape of the gas over the projectile, wads have been tried, but have been found useless. Experiments have also been made with metal caps attached to the base of the projectile, so arranged as to be expanded and pressed against the side of the base by the action of the powder. This mode appears to be a success.

**Ersatz-Reserve,** *vide* German Army.

**Escalade** (Latin *scala*, a ladder)—A sudden attack on an enemy's works, by means of escalading ladders. This is one of the most hazardous and dangerous operations in warfare, so much so that the leaders of an escalade constitute a "forlorn hope" (*q. v.*).

The mode usually followed in taking a place by escalade may in a general manner be described as follows. A strong party is formed under the cover of darkness (at early morn), and is provided with the necessary number of ladders, long and short, with which it proceeds to the point of attack, supported by a "firing party," and "supports." Having advanced over the glacis and covered way, and descended into the ditch, the escaladers thread their way to the curtain or bastion to be attacked, and place their ladders against the escarp. It is so timed that break of day shall find the escaladers ready to rush to the assault. As may be supposed, it is a period of intense excitement; all is done to hasten the ascent up the ladders—the utmost alacrity being exhibited. If opposed, as the escaladers would sure to be, the firing party must be in a position to enfilade and sweep off the defenders from the parapets. Close upon the escaladers, the main body of the troops follow. This kind of attack, which is exceptional nowadays, would only be resorted to when time is an object, and there appears to be every chance of success. The usual mode of gaining admittance into a place is by assault after a practicable breach has been made, and in *the attack of a formidable fortress* siege operations must be carried on to effect this.

**Escalading Ladders,** *vide* Ladders, Escalading.

**Escarp,** or **Scarp**—In fortification, the side of the ditch next to the place, which, in a permanent work, is faced with masonry. The scarp is less steep than the counterscarp, because it has to sustain the weight of the parapet. It is usual to give the slope of the scarp a base equal to two-thirds of the base of the natural slope of a mound of fresh earth the altitude of which is equal to the depth of the ditch. Vauban generally gave his revetments a slope of one-fifth of the total height of the wall.

**Escort**—A guard of troops attending an officer or person of distinction when travelling. It is also a guard placed over prisoners on a march, or over military stores in transit.

**Escuage**—The commutation of personal service into a money payment, such as is observed in the case of a substitute where compulsory service is enacted.

**Esplanade**—A clear space of ground separating the citadel of a fortress from the town.

**Esprit de corps**—A term well known in the army. It is usually understood to mean *brotherhood;* it means even more than this. As described in James' 'Military Dictionary'—"It is the feeling of attachment a soldier has for his regiment, even to the point of thinking it the best in the army. It fosters good-will and fellowship among officers and soldiers. It produces an emulous thirst after military glory. In fact, true *esprit de corps* creates such a feeling of enthusiasm and love for all that is honourable and noble that an officer or soldier will be careful in his conduct to do nothing which would bring dishonour or reproach on his regiment."

**Ess**—A couple or spare link in the form of an S, with holes to receive a leather thong. Esses are used to unite broken chains, traces, &c. Chains can also be lengthened or shortened by their means.

**Establishment** — The extent, *matériel*, and *personnel*, allowed to an army in peace or war time; in the latter case, it is regulated according to the exigencies of the service, which being much greater during war than peace has given rise to the distinction of a *war* and a *peace establishment*.

**Estimate**—A computation of the probable expense of any project or charges to be incurred, framed on recognised data, derived from previous experience, such as the yearly military and other estimates of the country.

**Estoc**—A small stabbing sword, introduced in the reign of Edward I.

**Etappen**—A department which originated in the Prussian military railway organisation, and which was first formed in 1867, and revised in 1869; subsequently certain changes were made during the war of 1870–71. The object of this department is to relieve the commander-in-chief and field army of all responsibility for their communications in the rear.

*Etappen* commissions are appointed to each loading and unloading station, to which a field officer as commandant, an adjutant, control officer, railway officials, and civil government officials, are attached. These officers supervise all local arrangements for loading or unloading, forwarding, feeding, billeting, &c. One of the officers originally appointed to this department was an inspector of *Etappen*; he was supposed to be a march in rear of head-quarters, superintending all necessary arrangements, but he had no authority over the civil departments with which he came into contact.

In 1870 the inspector was found to have too much to do, and a considerable amount of friction ensued. The commissariat officer attached received orders from an inspector and from his own chief. The railway subordinate was liable to some ten different chiefs, and the whole railway arrangements were half military, half civil.

New regulations were subsequently introduced which extended the powers of the inspector of *Etappen*. The official title is "Inspector of *Etappen* and Railways." He is present with head-quarters, and under him are placed—

Medical
Commissariat
Post-office
Telegraphs
} Under responsible heads.

The general principle or idea is this:—

*A line is* imagined to be drawn through *the head-quarters.* All in front belongs to the active army, all in rear to the *Etappen-Inspector*.

Our Quartermaster-General's department has to do both.

To take in the whole of the Prussian railway control, it would be necessary to describe in full the system pursued, which space will not admit.

An *Etappen* department has been raised in the French army after the Prussian system.

**Euphorbia Tirucalli**—This plant is much used in making hedges in India. It is an evergreen. The wood makes very fair charcoal for gunpowder purposes, but it is not equal to that derived from the urhur or dhall bush. In Bengali it is called *lunka sij*, and in Hindustani, *sendh*.

**Evacuate, To**—To withdraw from a town or fortress, in consequence either of a treaty or a capitulation, or of superior orders.

**Evidence**—As given before a court martial, is a declaration on oath by the witness of any circumstance he is personally acquainted with, having reference to the matter brought before the court.

The examination of the witness may be conducted either by his being told by the president or the judge-advocate, as the case may be, to state what he knows, or by means of question and answer, or by both. Every question, whether put by the prosecutor, the court, or the prisoner, must be in writing, and must first be handed to the president; if approved by him, it is entered in the proceedings. If not approved by the president, and the party insists on putting the question, the court, being cleared, proceeds to determine by vote (the president, in case of equality, having a second or casting vote) whether it shall be put or rejected.

**Evolutions, Military**—The movements by which troops change their position either for attack or defence. Those evolutions are best which can be executed with the greatest celerity compatible with regularity, and which are founded upon strict mathematical principles. In these days of arms of precision, it is necessary that change of movement should be as rapid as possible, so as to get into position without any unnecessary exposure.

This does not therefore permit in action of the square movements of former days.

**Examination**—An inquiry into the qualifications of those who are desirous of entering any particular service or employment. The examinations carried out for first appointments to the army are competitive. (*Vide* Appendix A.)

**Examination of Officers**—A system carried out in the army whereby commissioned officers are examined in military subjects before they are promoted to a higher grade. In accordance with the rules of the service, each officer up to the rank of field officer has to be examined in the subjects and drill laid down for officers of the army, before he can be promoted to the rank above that in which he is. In garrisons, periodical boards, or, as occasion may require, boards on application, are assembled for the examination of officers of the several ranks. Papers for the examination of infantry and cavalry officers are sent to the board by the Director-General of Military Education. The subjects officers have to pass in are laid down in the Queen's Regulations; they include *viva voce* questions; and the drill test in the field is under the eye and presence of the board.

Artillery and engineer officers are also examined by a board of officers in regimental duties, military law, and drill. The former are further required to pass an examination in artillery, and the latter must have passed satisfactorily at the School of Military Engineering.

The examination papers of infantry and cavalry officers, with the board's report, are sent through the general with his remarks to the Director-General of Military Education. Those of officers of artillery and engineers are sent through the general to the adjutant-general of their respective regiments, but answers to the questions in military law to the Director of Military Education. (*Vide* Appendix A.)

**Examination of Ordnance**—An accurate inspection of the bore and other parts of a gun. This is performed in the first place after a gun has been made; in the second, periodically, when the gun is in use; and lastly, in the case of smooth-bore iron ordnance, after each day's firing. *In firing heavy* rifled M.L. guns, it is ordered, as far as possible, that the examination of the 9-inch gun and heavier calibres shall take place after every 50 rounds; and the 8-inch, 7-inch, M.L.R. and B.L.R. guns, and 64-pr. M.L.R. gun, after every 100 rounds; the 64-pr. B.L.R. gun after every 150 rounds.

**Exchanges**—The permission granted to officers in the British army to exchange from one regiment to the other. Before the introduction of non-purchase in the army, it was competent for an officer to make any monetary arrangement with the officer with whom he exchanged; but a check was put on this, on purchase being abolished in the army, as it involved, so it was supposed, the opening out again of purchase in another form. This led to the subject being discussed in parliament, and the result is that a bill has lately been passed authorising officers to exchange under certain monetary and other conditions.

**Execution, Military**—Implies the punishment of a soldier by hanging or shooting. Formerly it comprised also flogging and running the gauntlet, &c.

**Exercise**—Manœuvring bodies of men together. The drill of a mounted battery of artillery is termed *exercise.* All such use as the soldier is instructed in in the knowledge of his weapon is termed *exercise*, such as bayonet exercise, firing exercise, lance exercise, manual, pistol, and sword exercise.

**Exercise, The Field**—A book published by authority, for the instruction of the soldier in the drill and evolutions of the army.

**Exercise, Firing**—The drill the recruit is taught in loading and firing his rifle, after he has learnt the manual exercise. This drill takes the name of what used to be the platoon exercise.

**Exercise, Laboratory**—The instruction imparted, in an arsenal, in the manufacture of combustible and warlike stores.

**Exercise, Manual**—A drill which the soldier has to practise in the handling of his rifle until he becomes proficient in the use of it.

**Exercise, Repository**—The mechanical manœuvres with heavy guns, where tackles, levers, capstans, &c. have to be used.

**Exercise, Shelter Trench**—An exercise which teaches the soldier how to cover himself quickly from the fire of the enemy.

**Expansion**—Is the general effect of heat in causing enlargement or expansion in solids, liquids, and gases. The effect of expansion is seen on heating spherical cannon-shot. Shot, on being slowly cooled, become permanently enlarged.

**Expansive Steam**—The method of applying and economising steam power in engines. It is thus explained in Weale's 'Dictionary of Terms of Art':—"If we allow steam to flow into the cylinder of a steam-engine, until the piston be depressed to one-half of the stroke, and then prevent the admission of any further quantity, the piston will, if the engine be properly weighted, continue its motion to the bottom. The pressure of the steam, so long as the supply is continued from the boiler, will be equal, it is presumed, to ten pounds upon the inch. With this force, it will act upon the piston until it completes one-half of the stroke: the further supply of steam will then be excluded, and that which is in the cylinder will expand as the piston descends, so that, when the stroke is complete, it will occupy the entire capacity. The pressure of the steam will then be half of its former amount, or five pounds upon the inch. During the descent of the piston, the pressure of the steam does not suddenly decrease from ten pounds to five, but it gradually declines through the successive intervals, until at the final point it yields that force. It is by this gradual expansion and diminution of the pressure that the superior action is produced."

**Expedition**—The organisation and march of a small army or body of men for hostile purposes. One of the principles of many small expeditions is surprise, which, if well carried out, will ensure success. To the soldier, no part of his duty is so exciting and interesting as an expedition, for it implies risk, hazard, and danger, in which nature of warfare the enthusiastic and daring soldier delights.

**Expense Magazines**—Are small gun-*powder* magazines, containing the made-*up ammunition* for the service of the guns on the works, at the rate of so many rounds per gun. In fortifications of an old construction an expense magazine was made in each bastion and battery, though this was not always the case. Expense magazines are often made under the earthen ramparts of fortifications, with a passage cut into them in the interior slopes. In more modern works, such as the 'Instruction in Fortification at the Royal Military Academy, Woolwich,' it is shown that expense magazines "should be placed as near as is practicable to the guns which they have to supply, and may often be conveniently constructed under the traverses and below the level of the terreplein, with lifts of communication. They can, if so situated, be easily secured against the enemy's fire, and be provided with subterranean commmunications with the main magazine, which would permit them to be replenished without risk, even during action."

The first suggestions made as to the size of expense magazines in fortifications of the present day gave four guns to be supplied by each, but a later recommendation proposes only two guns, in the case of very heavy guns.

**Explosion**—The sudden expansion of an elastic fluid with force and a loud report, such as is heard in the explosion of a magazine, the springing of a mine, the bursting of a shell, or the firing of a charge in a gun.

**Explosives, Ignitible** — Substances which, on a match, tube, or detonating composition being applied to them, ignite, such as gunpowder, gun-cotton, nitroglycerine, dynamite, and glyacyline, all of which can be used as explosive agents, for submarine as well as land purposes.

**Exterior Slope**—In fortification, is the slope given to the outside of the parapet. It is found by experience that earth of common tenacity will naturally acquire a slope of 45°, even when battered by cannon. This inclination is therefore given to the exterior slope in the first instance, in order that the fire of the enemy's artillery may not subsequently alter its shape.

**Extractor**—An instrument used in extracting a projectile from a M.L. rifled gun. That introduced into the service for every calibre of Woolwich projectile is constructed to act independently of the grooves of the gun. The term *extractor* is given to other articles of artillery stores, such as are used with the Gatling gun, and the instrument used in extracting a fuze from a shell.

## F.

**Face of a Gun** — The terminating plane, perpendicular to the axis of the bore of a gun.

**Faces of a Work**—In fortification, the name given to the two sides of a work which form its most prominent salient angle, such as the faces of a bastion or ravelin.

**Facing Implements**—Used for facing or renewing the vent and breech pieces of an Armstrong gun.

**Facings** — The name given to the colour of the cuffs and collar of the clothing of a regiment. Regiments are distinguished by the colour of their facings.

**Factory, Gun,** *vide* Gun Factories, Royal.

**Factory, Small-arm,** *vide* Small-arm Factory.

**Falchion**—A peculiarly shaped broad-bladed sword, added to the offensive weapons used in Edward I.'s reign, A.D. 1272–1307.

**Falconet** — The name given to the smallest kind of cannon used in the fifteenth and sixteenth centuries.

**Fall**—In artillery material, the name given to any rope which is passed through blocks, so as to form part of a tackle. The rope attached to a gyn, which passes over a double and triple block, the end of it passing round the windlass, is termed the *fall*. The fall for this purpose is generally made of strong rope, depending on the weight to be lifted.

**Fall, To**—A town or fortress is said *to fall* when it is compelled to surrender to a besieging army.

**False Attack**—A feigned assault made for the purpose of diverting the enemy from the real point of attack. False attacks should be carried out on several points of the works to be attacked, and at the same time as the real one is going on. The strength of the force detailed for this duty should be imposing.

**Fanfare**—A particular military sound made on the trumpet. A flourish of trumpets.

**Farcy**—A contagious disease among horses, caused often from want of ventilation, impure air, overcrowding, &c. It is the same disease as glanders, only in a modified form. (*Vide* Glanders.)

**Farriers** (Latin *ferrum*, iron)—Artificers attached to the mounted branch of the service for the purpose of attending to the care of the horses' feet. The farriers have general superintendence over the horses as regards their health, in subordination to the veterinary surgeon. In India, the European farriers overlook and instruct the native farriers in making horseshoes, and are responsible that the work is properly done. A farrier sergeant is eligible as a member of the sergeants' mess of a regiment.

**Fascines**—Twigs or brushwood fastened together, forming a cylindrical fagot, 18 feet long, 9 inches in diameter, and 140 lbs. in weight. Fascines are sometimes cut in two or three lengths, in the former case for covering galleries; in the latter, for crowning gabions in trenches. For revetting the interior slopes of works, fascines are largely used, together with gabions, sandbags, hurdles, planks, casks, &c.

**Fathom**—A linear measure, equal to 6 feet, and founded on the distance between the finger points when the arms and hands are extended horizontally. Rope is sold by the fathom. A coil of rope generally measures 120 fathoms.

**Fatigue**—The term given to a party of soldiers told off for any other duty than a dress parade necessitates.

**Fausse-braye** — In fortification, is a kind of second *enceinte;* since the introduction of the covered way, this work is quite inapplicable to a front furnished with and covered by a glacis.

**Feelers,** *vide* Light Cavalry and Scouts.

**Feint**—In military operations, a mock attack or assault, usually made to deceive an enemy as to the real intentions of his opponent. (*Vide* False Attack.)

**Fell Railway**—Takes its name from the inventor. The railway under this name was well known to travellers proceeding to or returning from India, as it was the only means of going over Mont Cenis, in Italy, before the tunnel was bored through the mountain. This nature of rail has been found useful during war time, and did good siege service during the Franco-German war. The gauge is 18 inches. Each truck carries three tons; 500 unskilled workmen can lay a mile in a day.

**Felloes**—Segments of wood dowelled together, into which the spokes of a wheel are fitted. A felloe consists of the back or streak side, the bosom or spoke side, and the chin, where the dowel pin is introduced. Each light gun carriage wheel has six felloes.

**Female Screw**—Formed by a spiral cavity cut on the concave surface of a cylinder, corresponding exactly to the thread of the male screw, which is to turn in it.

**Fencibles**—Regiments formerly raised for local defence, or at a special crisis, and for a limited time. The officers had the same rank as officers of militia according to the dates of their respective commissions. The only regiment now bearing this title is the Royal Malta Fencible Artillery.

**Fencing**—The art of attacking an adversary, as well as of defending oneself; a very salutary exercise for both officers and soldiers, rendering them expert in the use of the sword and other hand arms.

**Fetlock Joint**—The joint immediately above the pastern of a horse's foot.

**Feu de joie**—A discharge of musketry on the occasion of a victory, Queen's birthday, or some such joyful occasion. It consists of three discharges, commencing with the right of the line. A *feu de joie* is generally fired in conjunction with artillery, thus—a discharge of musketry, then seven guns, this repeated three times.

**Fever**—In veterinary practice, it is described as a disease characterised by increased heat, quick pulse, and thirst. In horses, it is caused by cold or chill, high feeding, irritation, or pain. The symptoms are lassitude, shivering, quick *pulse, and breathing* after feed. The cure consists in bleeding, and keeping open the bowels by clysters and laxative medicine. The animal's body and extremities should be kept warm by clothing and hard rubbing; the diet green meat, or bran mashes, chilled water; and the horse should be kept as quiet as possible.

**Fid**—A block of wood used in heavy gun exercise, for slinging the gun, and for mounting and dismounting purposes. The latest pattern of fid is of beech or elm, and each is provided with a rope grummet, and has the nature of the gun for which it is intended stamped upon it.

**Field**—The ground on which an army stands in the day of battle. The term is also expressive of troops when entering on a campaign, and as long as they are engaged against an enemy. Hence, when so situated, they are said to "keep the field."

**Field Allowance**—A daily sum of money granted to officers in her Majesty's service, at home or in the colonies, when placed under canvas. This allowance is granted to meet the extra expense caused in being so situated. A further extra allowance is granted when troops are engaged on service before the enemy.

In India there is no such allowance, as the pay officers receive is considered sufficient to enable them to keep up their camp equipage, and to meet all expenses attendant upon a move from cantonments or in setting out on a campaign.

**Field Artillery**—Comprises horse artillery and field batteries, which, from their lightness and mobility, are easy of draught, and hence fitted for rapid movements in the field. Mountain batteries come also under the category of field artillery. The horse artillery of the British service consists of wrought-iron 9-pr. M.L. rifled guns lined with steel, and the field batteries of 16-pr. M.L. rifled guns of the same material. The latter guns will in course of time replace the 12-pr. Armstrong guns still in the service.

**Field Fortification**—Works of a temporary nature thrown up for the preservation of a post, camp, &c.

**Field Hospital**, *vide* Hospital.

**Field Marshal**—The highest military rank a general officer can enjoy; it is in most cases bestowed on the oldest and most meritorious officers in the army.

**Field Officer**—An officer above the rank of captain and below that of general. Thus a major, lieutenant-colonel, or colonel, whether of brevet or regimental rank, is a field officer. A field officer in command of his regiment retains the command for five years, but can be reappointed at the will of the commander-in-chief.

**Field State**—A statement made over to the superior or reviewing officer on parade, showing the number of officers and men composing the troops, distinguishing those present and absent (on whatever account in the latter case) under their respective headings.

**Field Telegraph**, *vide* Telegraph.

**Fieldworks**—Temporary works thrown up either for the protection of troops or any particular position which it is not intended permanently to retain. Fieldworks, such as epaulments, trenches, rifle-pits, &c., are of great value to an army which has one of its tactical points weaker than the other, but the indiscriminate use of them should be guarded against. On this subject the following deductions may be drawn from the Franco-German war of 1870–71. Generals should not misuse them. The better drilled and disciplined the troops are, the more this kind of shelter may be employed, but it becomes dangerous to use it when the protection afforded is defended by soldiers who are not sure of themselves. Troops will remain in their covered position as long as they can, and it will be no easy task to make them leave their cover to attack in the open field. The result will necessarily follow, that the enemy, perceiving the impossibility of forcing the position in front, will turn it and outflank it.

In the British army, a short course of instruction in fieldworks is gone through by the infantry at all stations, where practicable, under the superintendence of the officer commanding the royal engineers of the district.

**Fife**—A wind instrument, generally used in military music as an accompaniment to the drum. James, in his 'Military Dictionary,' states that it is an instrument of high antiquity, and was used in the English army till the time of James I. After that time it was in disuse until the year 1747, when it was introduced into the foot guards by the Duke of Cumberland during the siege of Maestricht.

**Fight**—A battle or engagement between contending forces.

To *fight it out* is to continue the contest until one side or the other gets the better. The French express it by *se battre à outrance.*

**Figure of Merit**—Denotes the efficiency of the shooting of a squad, company, or battalion. The figure of merit is formed as follows:—

Average points obtained in the first and second periods.

*The aggregate points to be divided by the number of men who commenced the first period.*

Average points obtained in the volley firing.

Minus percentage of third-class shots at final classification.

INFANTRY.

| | Very good. | Good | Moderate. | When under. |
|---|---|---|---|---|
| Average points obtained in first and second periods together .. .. | 75 | 70 | 65 | 65 |
| Average points obtained in volley firing .. .. .. .. | 17 | 15 | 14 | 14 |
| | | | | When over. |
| Percentage of third-class shots at final classification (*minus*) .. .. | 8 | 12 | 16 | 16 |
| *Figure of merit* .. .. .. | 85 | 75 | 65 | 65 |
| Average points in independent firing.. | 18 | 16 | 15 | 15 |
| Average points in skirmishing .. | 9 | 8 | 6 | 6 |

**File**—In a regiment or squad, two men, a front-rank man and his rear-rank man. In single rank it means one man.

**File**—A strap or bar of steel, the surface of which is cut into fine points or teeth, which act by a species of cutting closely allied to abrasion. When the file is rubbed over the material to be operated upon, it cuts or abrades little shavings or shreds, which, from their minuteness, are called file dust; and in so doing, the file produces minute and irregular furrows of nearly equal depth, leaving the surface that has been filed more or less smooth, according to the size of the teeth of the file, and more or less accurately shaped, according to the degree of skill used in the manipulation of the instrument. The files employed in the mechanical arts are almost endless in variety; a description of them therefore is not given in this work.

**Fillets**—Bands or mouldings on smooth-bore guns, such as the vent field and muzzle fillets (*q. v.*).

**Filtration**—In chemistry, the separation of solids from liquids. The apparatus in chemistry required for this purpose are funnels and funnel stands, lute jars or beakers, stirring rods, glass plates, a wash bottle, and filtering paper. The best paper for filtering purposes is that imported from Sweden.

**Finance, Army**—A civil department of the War Office, which regulates every military expenditure. Upon this department devolves the close scrutiny and inspection of all accounts, the revising of all estimates, periodical or otherwise. This department also furnishes to government every explanation as to the necessity of any particular expenditure to be incurred. It may be said to be one of the most important departments of the army.

**Financial Secretary**—One of the three principal officials under the Secretary of War. In this office is vested the control of the pay and audit of the army.

**Finding**—Is that part of the proceedings of a court-martial when, the evidence having been concluded, the court proceeds to deliberate with closed doors on the guilt or innocence of the prisoner. The president takes the votes of the court, beginning with the junior member: a majority of votes decides whether the prisoner is "guilty" or "not guilty."

**Fire, To**—To discharge a piece of ordnance or any fire-arm. To ignite a mine or train of powder.

**Fire, Vertical**, *vide* Vertical Fire.

**Fire-arms**, *vide* Arms.

**Fire-bricks**—Used for lining furnaces, and for all kinds of brickwork exposed to intense heat which would melt common bricks. They are made from a natural compound of silica and alumina, which, when free from lime and other fluxes, is infusible under the greatest heat to which it can be subjected. Oxide of iron, however, which is present in most clays, renders the clay fusible when the silica and alumina are nearly in equal proportions, and those fire-clays are the best in which the silica is greatly in excess over the alumina.

**Fire-engine**—A portable machine used for extinguishing fires in barracks and permanent camps. The engines are worked by soldiers who are exercised periodically in the use of them. The following notes regarding the preservation of the water-hose attached to the engine may be found useful:—

"The engine, hose, and implements, &c. should be invariably kept in good condition, and fit for immediate use, if required. After every working of the engine, all component parts should be carefully examined, and any slight repairs that may be needed effected immediately.

"The hose should not be dragged along the ground, but after use should be coiled and taken to the work-yard to be cleaned. If of leather, it must be washed clean, hung up to drain, and, while partially wet, a mixture of neats-foot and cod oil rubbed on with a brush. If of canvas, it must also be washed clean, hung up to drain, and not folded until perfectly dry. It should, whether of leather or canvas, be unfolded at least once in every six weeks, and kept exposed in an airy place. If kept too long coiled, leather is liable to heat and harden. When it has had a good airing, and is well softened, it may be again coiled. Anoint leather hoses with the mixture above given at least once in every two months.

"If the engine has been sent away for use on account of a fire (or after travelling), wash it on its return before dirt has had time to harden, and pump clean water through the works, moving the levers rapidly to remove mud, grit, &c. The cylinders, after being wiped dry and clean, should be examined to see if they have sustained any injury, and the pistons covered with salad or olive oil for lubricating the cylinders and keeping the leather cups moist. When you play an engine, place the branch pipe, if possible, in such a position that its jet may be assisted by the wind. In extinguishing fire, the branch pipe should be brought as near as possible to the premises on fire, and if the firemen cannot enter the house or building, use ladders, if desirable. What is wanted is, to play with full power on the burning materials and cut off the flame at its source. It is the *force* of the water and not the *quantity* that has the greatest effect. The men working an engine should commence pumping slowly, gradually increasing or quickening the movement, throwing all their weight on the down stroke, and allowing the handles to rise by the depression of the levers on the other side."

**Fire-hook**—A hook for pulling the thatch off barracks and other buildings so covered, in case of fire. Fire-hooks are made in India of *sal* or any other suitable wood, when bamboo is not procurable.

**Fire-ladders,** *vide* Ladders, Fire.

**Firelock**—A term applied to a musket with a flintlock; so called from producing fire of itself, by the action of flint and steel. Firelocks were invented about 1645, and they superseded the matchlock some years later. The Dutch appear to have been the inventors of this arm. The name, though the arm is obsolete, is still current among soldiers.

**Fire-master**—A post formerly held in the Royal Arsenal, Woolwich, by an officer of artillery, whose duty it was to attend to all laboratory work. The designation of fire-master is still known in the ordnance branch of the service; he is an officer of the royal artillery, and is entrusted with the inspection of ordnance stores at foreign stations.

**Fire-worker**—Formerly an assistant to the fire-master. In the early organisation of the British artillery, this title was given to the junior subaltern grade, the designation of the officer being lieutenant fire-worker.

**Fireworks**—A pyrotechnical display, used chiefly on days of rejoicing and fête days. Fireworks are made up in the laboratory of certain combustible stores, in which the ingredients of gunpowder form the larger part. The variety of stars and colours observed in fireworks is formed principally of metallic filings.

**Firing Exercise,** *vide* Exercise, Firing.

**Firmness**—Represents steadiness, constancy, resolution. Firmness of character and firmness of purpose are such essential qualities in the commander of a regiment or army that the want of it is the sure forerunner of disorganisation and disaster. Without firmness of purpose in dealing with soldiers, no regiment or body of men can be commanded.

**Fisherman's Knot**—A knot used in pontooning to fasten the cables to the rings of the anchors.

**Fishing Spars**—In artillery material, consist of spars of wood placed parallel to the spars to be strengthened, by lashing them to one another.

**Fit for Service**—From this expression is understood, being in a good state of health and capable of bearing fatigue. The complaints which disable a soldier from being "fit for service" are laid down by the medical department, and are such as to incapacitate a man from doing his duty.

**Fittings**—The name given to certain fixtures in a barrack or on board a military transport for the purpose of keeping up a current of pure air, and for receiving the knapsacks and arms. They are as follows:—

Ventilators.
Knapsack and arm racks.

If there be sufficient height for knapsacks, they should be placed in battens over the men's mess place. If the deck be lower than 6 feet, they should be packed separately. The fittings in the officers' cabins are of the usual nature. For the convenience of the sick, a portion of the ship is set apart which has certain fixtures. Should the wives of the soldiers accompany them, standing bed places are erected, which come under the head of *fittings.*

**Fixed Ammunition**—When the cartridge is attached to the projectile, the two together are termed "fixed ammunition." During the last, and even in the beginning of the present, century, this nature of ammunition was used for all calibres, but latterly it has been restricted to the 3-pr. S.B. for mountain service in India or elsewhere, wherever this gun may be used.

**Flag**—An ensign or colour on which are usually worked certain figures or devices, carried by each regiment as its distinguishing mark. (*Vide* Colours, Military.)

**Flag, National**—Is the union jack, which is authorised to be hoisted in all fortresses at home and abroad; also by certain authorities, such as the governors of dependencies, commanders-in-chief, general officers in command, &c.

**Flag of Truce**—A flag (generally a white handkerchief) attached to a staff and carried by an officer sent to communicate with the enemy. Besides the flag, the approach is also signified by the sound of a trumpet. The Queen's Regulations direct that persons bearing a flag of truce from the enemy are to be treated with attention and civility; but as the object of such communications is sometimes to spy out the nakedness of the land, or, in other words, to gain information as to what is going on in the enemy's camp, the flag should be received with great reserve and caution, and, if necessary, the eyes of the bearer should be bandaged.

**Flag-staff**—A mast or pole on which a flag or standard is hung. One is allowed to each fort or fortress, and to the governors of our several dependencies, to commanders-in-chief, and to officers commanding divisions or districts of the army.

**Flam**—A beat or tap upon the drum which was formerly used in the British army, when regiments were going through their drill or exercise, every formation being done by tap or beat upon the drum. It was likewise beat in firing practice whenever the target *was struck.*

**Flanders Wagon**—A wagon suited to the transport of all light stores, and, though still in existence, is of an obsolete pattern.

**Flange, or Flanch**—The projecting rim of metal on the circumference of a wheel or cylinder to serve as a bearing, for example, the rim on the tire of railway wheels. The rim of metal round the mouth of gun caps used with percussion muskets is called a flange.

**Flank**—The extreme right or left of a body of troops or a military position. In fortification, the flanks of a work are those parts which afford flanking defence.

**Flank Attack**—In warfare, one of the modes of attack whereby the side or flank of an army or body of troops is attacked. Before the introduction of rifled guns and arms, the *attack in front*, by heavy columns of infantry covered by skirmishers and guns, was the usual mode of attack, but since then it has been found, in consequence of the withering and rapid fire of rifles, that, depending alone upon such an attack, a front advance is attended with extreme danger. Troops advancing in column under such circumstances necessarily break up into skirmishers, the column form becomes somewhat abandoned, both in the leading columns, supports, and reserves, as each moves up into action. To remedy this, attack in flank or rear is come to be received as the best mode of attack; not that the front attack is to be altogether given up, for to insure success such an attack is still necessary, though modified: otherwise the enemy would be free to meet and frustrate the flank movements; so that really the attack of the present day is a combination of front and flank.

**Flank Defence**—In fortification, is the means adopted in the trace of a work to preserve all parts of it from being unduly exposed to the direct fire of the enemy, such as would be the case if a parapet had alone to protect itself in a direct line upon the besiegers. Again, the face of a work is said to receive *flank defence*, or to be *flanked*, when the fire of another work is directed parallel or nearly so to its escarp, so as to defend its ditch or the ground in front of it. Any work not so provided would be liable to be captured without difficulty. Take for instance a faultily constructed work, permitting of the assailants getting close up under the rampart without the defenders seeing them; in this position a few bold resolute men, with crowbars and a bag of powder might, by making a cavity in the escarp, destroy a portion of the rampart. To prevent however such a possibility, three systems have been devised for giving flanking defence to a permanent work. They are the tenaille system, the bastioned system, and the polygonal system.

Extreme precaution has to be taken in field or permanent works to give them good flanking defence.

**Flank Movement** — This term has reference to the change of march of an army or a portion of an army, which circumstances may necessitate, and which may occur when a battle is being fought, with the view to turning either one or both wings of the enemy, or a better position being taken up. In making a flank movement before the enemy, it would be difficult to carry out the usual order of march, as laid down for the march of an army to the *front*. Such a formation would be inconvenient to a large body of troops, if the ground or country was circumscribed or enclosed, having to march in one direction and to fight a battle in another, thus necessitating a long wheel of its columns before coming into action. To avoid this, a new order of march must be pursued.

Colonel Hamley, in his 'Operations of War,' points out what should be done under the circumstances. "On perfectly open ground such a movement might be accomplished by marching to a flank in order of battle, that is, in three columns formed of the two lines and the reserve, with an advanced guard protecting the flank towards the enemy. But the question is of making a march of this kind in an average broken or enclosed country, where very lengthened columns, especially of cavalry and artillery, could not without great risk offer their flank to the enemy." Colonel Hamley then gives the order of march to a flank, and winds up in saying:—"When a corps is moving thus to a flank, it will be of immense importance to decide *whether it is to* form line of battle to a front or a flank, relatively to the rest of the army and to the enemy. Thus Bülow's march to the field of Waterloo was a *flank march;* but for the attack on the French flank, the order of march to *a front* was the proper formation for his columns."

He further states that—"The turning of the flank of a line of battle may be effected either by originally directing part of the army beyond that flank or by reinforcing one wing of a direct attack, and deploying the added troops beyond the menaced flank during the engagement. The Prussians always seem to have operated in the latter way, engaging at the same time throughout the front. The history of the victories of the summer of 1870 is that the German corps march straight for the enemy, that the leading troops at once attack, that the rest hurry up to their support, extending and deepening the skirmishing line, and that, after a severe engagement, an extension beyond a flank renders the position untenable."

**Flank, Pivot**—When a regiment is drawn up in column right in front—that is, when the company which stood on the right, when in line, is in front—the left-hand man will be the pivot flank of each company. When the column is left in front, the right-hand man will be the pivot flank of each company.

**Flank, Reverse**—The extremity of the division furthest from the pivot flank.

**Flanks, Retired**—In fortification, are those made behind the line which joins the extremity of the face and the curtain towards the capital of the bastion.

**Flaw** — In casting or forging, any crack or opening which may be observed. In forging it occurs from bad welding.

**Flèche** — In fortification, the most simple species of fieldworks; it is quickly and easily constructed, and therefore frequently used in the field. It usually consists of two faces forming a salient angle towards some object, from whence it cannot be approached on the prolongation of its capital. One simple rule for the construction of a flèche is to select a spot for the salient, and to throw up a breastwork on either side forming an angle of not less than 60 degrees, and allowing a distance of a yard to each file.

**Fleeting** — This term is applied to shifting or overhauling a tackle.

**Flintlock** — May be described as a modification of and improvement on the wheel-lock, which was attached to the old musket for the purpose of discharging the piece. In the 'Text-book for Musketry at Hythe' it is shown that the modern firelock, the *flintlock*, was invented about 1635, suggested, no doubt, from the snaphaunce described elsewhere, and from which it only differed by the cover of the pan forming part of the steel or hammer, which retained its furrows until the eighteenth century. Before the invention of the flintlock, the wheel-lock was frequently called the firelock. The flintlock does not appear to have been employed in England until 1677.

**Floating Target** — A floating mark for the practice of artillery firing seawards. It consists of a raft made of two pieces of deal 10 feet in length, 9 inches wide, and 3 inches in thickness, united together crosswise, and having a cask, an ordinary half-ton vat, placed on it and secured by four wooden snugs and four small guy lines.

A flag-staff 2½ inches in diameter, and 14 feet in height, with a flag 4 feet 6 inches by 4 feet, is inserted upright in the vat, and secured by four guys to the extremities of the raft.

A 3-inch rope, 18½ fathoms in length, with an iron shackle at one end, for attaching an anchor or grapnel, is made fast to the raft.

**Flourish**—Any vibration of sound that issues from a musical instrument.

**Flourish of Trumpets**—The sounding used by regiments, having no bands, in receiving a general officer on parade, viz. by the trumpets or bugles sounding the "flourish."

**Flowers of Sulphur**—The pure sulphur obtained by sublimation, which appears in the neck of the retort in the form of a very fine powder, known as "flowers of sulphur."

**Fluorine** — An elementary principle contained in fluor-spar, which is so called from its acting as a flux in the working of certain minerals. (*Vide* *Baume's* Flux.)

***Flux***—*A substance* or mixture used to promote the fusion of metals or minerals. The fluxes generally used are alkalies. Limestone, fluor-spar, borax, are among the principal fluxes.

**Fly Wheel**—A wheel, with a heavy rim, fixed upon the crank shaft of a land engine for the purpose of equalising the motion, by the centrifugal force absorbing the surplus force at one part of the action, to distribute again when the action is deficient.

**Flying Bridge** — Consists of one or more barges moored by a long cable to a point in the centre of the stream. When the barge is properly steered in a current sufficiently strong, it is swept by it from one bank to the other. The proper form of vessels for flying bridges should be long and narrow. For the value of this nature of bridge, *vide* Bridges, Military.

**Flying Brigade** — A force of three, four, or five thousand troops, principally of cavalry, kept constantly in the field to cover its own garrisons, and annoy the enemy.

**Flying Camp**, *vide* Encampment.

**Flying Sap**—In fortification, is a sap formed by placing and filling several gabions at the same time; which may be done at times when the attack is slack. The term is also applied to the usual formation of the second parallel in the attack.

**Fodder**, *vide* Forage.

**Followers, Camp**, *vide* Camp Followers.

**Foot** — A linear measure of twelve inches.

**Foot Guards**—Consist of the following regiments: the Grenadier, Coldstream, and Scots Fusilier Guards. They form the guard over her Majesty's person, and the garrison, ordinarily, of the metropolis. The officers of these regiments hold higher army rank than that they bear regimentally.

**Foot-tons** — A convenient mode of calculating or expressing the "work done" on impact by a body in motion. (*Vide* Energy.)

**Forage** — The daily ration of food given to horses and other animals in the service. It is of two kinds, green and dry; the former consists of green grass, tares, vetches, &c.; the latter of oats and hay, and sometimes of corn and barley, according to circumstances and the country in which the horses may be serving. The daily ration laid down for all horses is 12 lbs. of oats and 12 lbs. of hay, which is distributed in three portions, and given at morn, noon, and at eve; pack animals get less, viz. 8 lbs. of oats and 10 lbs. of hay. In India, the daily food given to horses consists of gram and grass. Generally 4 seers or 8 lbs. per horse is given of the former during the hot season, and 5 seers or 10 lbs. throughout the cold weather, and when the horses are on the march. Grass, about 30 lbs. daily, is provided by grass-cutters, of whom there is one to every horse, or one to every two; but in the latter case, the grass-cutter has to provide a pony, and bring in grass for two horses, for which he receives double wages. The grass is cut from the surrounding country; the men going sometimes 15 or 20 miles to gather it. Surplus grass is very often stacked by officers, by which means a ready supply of hay is at hand when grass is scarce, which occurs in some districts in the north-west of India, during the hot and dry season. On the march, should it be difficult to obtain grass, a requisition is made on the civil authorities to collect it at any named place. The fodder for bullocks in India consists of 6 lbs. of grain and 14 lbs. of chopped straw called *bhoosa.* Camels feed on the leaves of the pepul tree. Elephants are fed on wheaten cakes mixed with molasses, called in India *gour.* The daily ration is from 15 to 30 lbs. according to the size of the animal. The green food consists of sugar cane or green leaves of different trees.

**Forage Cap**—The undress cap worn by infantry soldiers, and known as the *Glengarry forage cap.* When not in use, it is secured under the straps of the soldier's pack.

**Foraging Parties**—Are men of different regiments, infantry and cavalry, who are employed in collecting fuel or straw, or in carrying water from an enemy's country. If the troops on this duty exceed twenty men, and have any distance to march, a subaltern officer is to be put in command of the party.

**Force**—Any cause which produces, or tends to produce, a change in the state of rest or motion of a particle is called *force.* The term is also applied to an armed body.

**Ford**—The shallow part of a river, where troops can cross without injuring their arms. The depth of fords for cavalry should not be more than 4 feet, and for infantry 3 feet; should the stream, however, be very rapid, depths much less than these could not be considered fordable, particularly if the bottom is uneven. Gun carriages with wheels 5 feet in diameter may cross a ford 4 feet deep; but as it is necessary to keep their contents dry, the depth should not be more than 2½ feet. If the force of the current be great or rapid, it may be broken by the cavalry crossing a little above the ford; but if the bottom be sandy, the cavalry should cross after the infantry and artillery, as the passage of the former deepens a ford sometimes very materially. Care must be taken that the horses are not allowed to trot in fording, nor to halt while crossing.

In searching for fords, it will generally be found that the widest parts of rivers are the shallowest, and that in a straight line across. In the bend of rivers the water is deepest, and, moreover, the bottom at curved parts is never firm throughout. Rivers, however, which are not anywhere fordable in a perpendicular line across may be found to be so in a slanting direction between two sinuosities. Before committing the troops to a ford, it should be well reconnoitred, and this can easily be done by descending the river in a boat and taking soundings.

Colonel Hamley, in his 'Operations of War,' lays down the following features to be observed in reconnoitring fords: —"Their banks, their bottom, their level at entering and quitting the water. Their position, whether in angles, windings, or straight parts of the stream. The direction of the ford—depth and rapidity of stream—whether the ford is shifting or permanent—command of the banks. Points existing in the neighbourhood of which use may be made to deceive the enemy as to the real point of passage."

**Foreign Armies**—Represent the continental armies.

Looking at the armies of Europe from every point of view, their strength, the rapidity with which they can be mobilised, and the means of feeding them, they may be classed as follows:—

|  |  |
|---|---|
| First class | 1. Germany. |
|  | 2. France. |
|  | 3. Russia. |
|  | 4. Austria. |
| Second class | 5. Italy. |
|  | 6. England. |
| Third class | 7. Belgium. |
|  | 8. Turkey. |
| Fourth class | 9. Sweden and Norway. |
|  | 10. Holland. |
|  | 11. Denmark. |
|  | 12. Spain. |
|  | 13. Portugal. |
|  | 14. Switzerland. |
|  | 15. Greece. |

The four armies of the first class can place together in the field, in round numbers, a combatant force of 3,400,000 men and 8652 guns, whilst they can count twice that number of men on paper. The expense of these armies exceeds £67,000,000 per annum. Russia, Turkey, and Austria keep their troops at least cost, viz. from £25 to £29 a year per man; the maintenance of the British soldier is by far the dearest, as it amounts to close upon £100 per annum. In Germany the cost is £38 11s. per man.

Of the above named fifteen states of Europe, seven have introduced the compulsory service as the means of raising their armies—Germany, Russia, Austria, France, Italy, Denmark, and Switzerland. Seven are recruited by conscription, or conscription and enlistment, viz. Spain, Turkey, Sweden and Norway, Holland, Belgium, Portugal, and Greece. The British army alone is solely dependent on voluntary enlistment.

In the following armies the age for joining the colours is 20, viz. Austria, France, Russia, Spain, and Switzerland; 21 in Germany and Sweden; 19 in Belgium; 18 in Italy, and 22 in Denmark and Norway. In England men enlist between 18 and 25.

*The term of* service in Austria, Germany, Italy, and Greece, is 12 years; in Russia, 15; in France and Turkey, 20; in England, 12; in Denmark, 16; and in Switzerland, 10. The direct term of army service, that is to say, the term the recruit or the conscript has to remain in the active army before entering the reserve (exceptions omitted), is in Austria, Denmark, France, Germany, and Italy, 3 years; in England, 6; in Sweden and Norway, 5; in Turkey and Russia, 4.

The training of a recruit lasts in Austria 8 weeks; Germany and Italy require but 6; Russia deems 26 requisite; France finds 13 sufficient; England, 16; whereas Turkey considers 12 weeks necessary for the drill education of her soldier. The active army in Austria is composed of the line, reserve, and eventually of the *Landwehr*, together with the substitute reserve. In Germany the active army is composed of the same parts. Russia forms hers of the line, reserve, and militia, who have served but 4 years in that branch of the army. France has her active army, and her reserve, followed by the territorial army and the reserve of the territorial. As in the case of Russia, her reserves as well as her territorial armies are but on paper, as sufficient time has not elapsed for the new system to mature. Italy has the line and the *mobile milizia*. In Turkey the active army is followed by three reserves, the *idatyal*, the *rédij*, and the *hiyade*, the latter being a kind of *Landsturm.*

In the six principal armies of Europe the proportion of guns and cavalry on active service to the strength of infantry is as follows:—

|  |  |  |  |  |  |
|---|---|---|---|---|---|
| Austria has .. | 103 | cavalry and | 4 | guns | per 1000 men. |
| France .. .. | 119 | ,, ,, | 3 | ,, |  |
| Germany .. .. | 117 | ,, ,, | 3 | ,, |  |
| Russia (Europe) | 178 | ,, ,, | 4 | ,, |  |
| ,, (Asia) .. | 910 | ,, ,, | 3 | ,, |  |
| England .. .. | 133 | ,, ,, | 4 | ,, |  |
| Italy .. .. .. | 57 | ,, ,, | 3 | ,, |  |

The Austrian infantry is armed with the Werndl rifle, the Bavarian with the Werder, and the remainder of the German infantry with the Mauser rifle. France is gradually providing her troops of the line with the modified Chassepôt called the Gras rifle, from the name of the officer who has improved this weapon.

Denmark, Norway and Sweden use the Remington rifle. Italy and Switzerland have adopted the Vetterli rifle; Russia the Berdan, and Spain the Remington. Belgium has found the Albini-Braende rifle superior to all, and England and Turkey the Martini-Henry. The American troops are armed with the Springfield rifle.

Before closing this article on the small-arms of the several foreign armies, a statement of the guns used by the four largest continental powers may be considered interesting. The field batteries of the German army are armed with the 8·8-centimetre B.L.R. gun, firing a shrapnel of 17 lbs. weight; the horse artillery with the 7·85-centimetre B.L.R. gun, firing a shrapnel weighing 12·2 lbs. These guns are made of cast steel, with polygrooved rifling and wedge-break action (*vide* Krupp). For siege purposes the Germans use the 12-centimetre (4·68-inch) bronze gun, firing a 29-lb. shell, and steel and bronze guns of 15-centimetre (6·85-inch) calibre, firing a 54-lb. shell. A 21-centimetre shell gun is soon to be added to this arm.

The field artillery of Austria is composed of 8-pr. and 4-pr. bronze rifled guns, having calibres of 3·9 inches and 3 inches, firing 14-lb. and 8-lb. shell respectively. Steel B.L.R. guns of the Prussian type are, however, being gradually introduced. (*Vide* Austrian Gun.) The mountain batteries are armed with 3-pr. rifled bronze guns; and for siege and garrison purposes the guns in use are B. L.R. 15- and 21-centimetre and 8-inch bronze guns.*

The Russian field artillery is armed with both cast steel and bronze B.L.R. guns, 4-prs. and 9-prs. of 3·3-inch and 4-inch calibres, firing 12-lb. and 24-lb. shell respectively. For siege and garrison artillery they use 12-pr. and 24-pr. guns, throwing 30-lb. and 63-lb. shells, and 8-inch bronze and steel guns. The mountain gun is a 3-pr. bronze rifled gun, firing a 9-lb. projectile.

The field guns of France are the 14-pr. steel and 10-pr. bronze B.L.R., the former the production of Colonel Reffye, the latter made by Major Pothier, and a steel 7-pr. B.L.R. gun of a new pattern. (*Vide* Appendix C.)

**Forge**—A furnace or place where iron is heated and beaten into shape. Forges are either stationary or portable. The former comprise all those used in workshops, the latter with batteries of artillery. In large establishments, the forges are always blown by steam.

**Forge, To**—To beat out, or form by the hammer, metal which has been heated in the furnace. Steam hammers are very generally used for this purpose in all large smithy establishments.

**Forge Wagon**—A wagon attached to each horse and field artillery battery, to admit of repairs and other work being effected to the carriages, when on the move.

**Forlorn Hope**—In military language, signifies men detached from several regiments, or otherwise appointed, to form the storming party of an escalade or in the assault of a breach. In the French army, the forlorn hope is called *enfants perdus*, from the great danger and imminent risk to which it is unavoidably exposed. By the Germans it is called *verlorner Posten.*

**Form, To**—In drill or in military movements or dispositions, to assume or produce any shape or figure, extent or depth of line or column, by means of prescribed rules.

**Formers, Cartridge**—Wooden shapes for cutting out the form and size of cannon cartridge bags; their size and shape depend on the nature of the cartridge to be made.

**Formers, Port-fire**—Used for making port-fire cases. They are made of wood, of a diameter slightly larger than the port-fire setting drift.

**Formers, Signal Rocket**—For forming the cases of signal rockets. They have a movable piece from two to three diameters in length, which is termed the nipple, the smaller end of which fits into a hole made in the *former*, and, when slightly drawn out, keeps the neck of the case open while the choke is being formed and secured.

**Formers, Wad**—Flat circular pieces of wood, hollowed out and grooved. They are used for making up grummet wads for M.L.R. guns.

---

* Since the above was written, the Austrian government has adopted a new gun, of steel-bronze, the invention of General Uchatius. (*Vide* Steel-bronze Gun.)

**Fort**—In fortification, a work built for the protection of any particular spot of importance, and erected either as a permanent or field work. In the latter case, star and bastion forts are the most common.

**Fort Adjutant**—An officer holding an appointment in a fortress analogous to the adjutant of a regiment, his duties being chiefly with detachments of troops which are often located within the fortress.

**Fort Major**—The staff officer employed in carrying out the duties of a fortified town. He ranks, if under the rank of captain, next after the captains in the garrison in which he is serving.

**Fortification**—The art of strengthening a town or other place, or of putting it in such a posture of defence that every one of its parts defends and is defended by some other parts, by means of ramparts, parapets, ditches, and outworks, to the end, that a small number of men within may be able to defend themselves, for a considerable time, against the assaults of a numerous army without. It is very generally understood that the word fortification is derived through the Italian from the Latin *fortis* and *facere*, meaning literally "making strong." Albrecht Dürer, the celebrated painter and engraver, who lived in the sixteenth century, is stated to have been the first writer on fortification. His principal system consisted simply of very large semi-circular towers called *Basteien*, and also *Rondele*. His works show great talent in fortification.

Fortification has been considered by military writers under two heads, viz. *permanent* and *field*. The former, as its name implies, is built to last an indefinite time, thus becoming a permanent work, and defence to all within its enclosure. It has for its object the protection of the frontiers of states, arsenals, depots of stores, towns, and everything that may add to the security of a state. The latter is only a temporary work thrown up for the protection of armies in the field, when it is found necessary to strengthen a position.

**Fortify, To**—To strengthen any place by artificial or other means, so as to render it strong enough to bid defiance *to any meditated* attack or assault.

**Fortress**—In fortification, the name given to a permanent work or fortified city. The continent affords examples of some first-class fortresses, such as Strasburg, Metz, and others, including Paris, which capitulated to the Germans during the war of 1870–71. The two first-named fortresses, since the war adverted to, have been considerably strengthened by the Germans to meet the arms of the present day.

The value set on fortresses in the sixteenth and seventeenth centuries was very much exaggerated. The opinion that no advance of armies could take place, on any particular point, without fortresses in the way being reduced, was subsequently set aside by Napoleon daring to pass by or to neglect fortresses, and advance to the attack in the field. It came, however, subsequently to be received that fortresses were of great value in rallying a defeated army.

In fortresses, the armament, with the ammunition and artillery material of all natures, is placed under the officer commanding the artillery. The number of guns forming the armament of a fortress is shown under the head of "Armament," to which the reader is referred. The amount of ammunition that should be supplied is shown in the 'Instruction on Fortification, &c. at the Royal Military Academy, Woolwich,' as follows:—"The quantity of ammunition provided for the artillery should be regulated according to the nature of each fortress, those that are classed under the head of—

First class, requiring 700 shot or 500 shells
Second ,, ,, 600 ,, ,, 400 ,,
Third ,, ,, 500 ,, ,, 300 ,,
} for each piece."

**Forts, Bastioned**—Forts so traced that from the parapet a complete flanking defence is afforded to the ditch in all its parts.

**Forts, Star**, *vide* Star Forts.

**Fougass**—A small mine from 6 to 12 feet under ground, charged either with powder or loaded shells, and sometimes loaded with stones instead of being tamped in the ordinary way.

**Foundry, Gun**—A building in which metals (bronze or iron) are cast in moulds or shapes for gun purposes. The subsequent operations of boring, rifling, and finishing off the gun, are carried out in rooms specially adapted for the work to be performed in each. Since the introduction into the service of wrought-iron guns, the casting of guns, whether of iron or bronze, has ceased; and all guns in the British service are now formed of wrought-iron bars, wound, while red hot, into a coil round a mandril, a steel tube forming the barrel of the gun.

**Fractions**—Are known as either *vulgar* or *decimal.* Vulgar fractions denote a part or parts of a unit. They are expressed by two numbers placed one above the other, with a line drawn between them. The lower number is called the "denominator," and shows into how many equal parts the unit is divided; the upper is called the "numerator," and shows how many of such parts are taken to form the fraction. Decimal fractions differ from vulgar fractions in having always the same denominator, and following the same laws as whole numbers, like which they can be treated in every respect. They are represented like ordinary figures, and distinguished by a dot on the left hand side; thus, ·456, expressed fractionally, represents 4-tenths *plus* 5-hundredths *plus* 6-thousandths, or 456-thousandths.

**Fraise**—In fortification, a palisade inclining to the horizon, placed for defence round a work near the berm.

**Franc-tireurs** (French, *franc*, free; and *tireur*, shooter)—The first bodies of *franc-tireurs* were formed in the Vosges. They were volunteers who met once a week for shooting practice; with them rested the defence of the defiles of the Vosges.

During the Franco-German war of 1870–71 numerous bodies of these volunteers were raised. They were mostly composed of old soldiers or men exempt from military service. These free bodies, drawn from the provinces occupied by the enemy, were to be employed as guides or scouts, or, from their knowledge of the country, were to harass the enemy, cutting off his supplies and inflicting the utmost possible injury. During the first part of the war they rendered great service, and also during the siege of Paris. *Those that were* raised under the Republic, badly officered, without control, without discipline, composed mostly of men who shrank from the hard duties of military discipline, proved to be a greater nuisance to the French peasants than to the German soldiery. They also brought great suffering upon the inhabitants, who were punished by the Germans for the work of the *franc-tireurs.* Villages were burnt, and the chief inhabitants shot, if it was found that a band of these irregulars had been harboured in any way. They were not considered as belligerents by the Germans, although they were recognised as such by the French war office, subject to the French military law, and commanded by French officers. The German military authorities gave notice that they would be looked upon as banditti, and shot when seized.

**Frapping**—In artillery, drawing together the several turns of a rope or tackle, which have been already strained to the utmost. The end of the rope or tackle may be used for this purpose.

**Fraser Gun**—This gun takes its name from Mr. Fraser, of the Royal Gun Factories, Woolwich, and is a modification of Sir W. Armstrong's original gun, which was built up of several short single wrought-iron coils shrunk together and a forged breech piece. In Sir W. Armstrong's system, the number of coils which had to be shrunk on entailed time, expense, and labour, as each coil, as it was shrunk on, necessitated the mass being moved from the shrinking-pit to the turning-lathe, and turned down for the next and succeeding coils to the smoothness of glass.

In Mr. Fraser's construction, which differs from the Armstrong principally in building up a gun of a few long double or triple coils, only two shrinkings are necessary, and as described by Captain Stoney, R.A., in his paper "On the Construction of our Heavy Guns" (from which the above information has been derived), "where fifty tons were moved in the former case, only seven are moved in the latter."

Again, Captain Stoney says, in remarking also on there being less waste of material:—"From these circumstances, combined with the employment of a cheaper iron, a 'Fraser' gun can be made at two-thirds of the cost of a gun of the same nature as originally manufactured."

**Freeburn Fuze**—A concussion fuze, made of wood; it is now obsolete.

**French Army**—One of the chief continental armies of Europe.

Early in 1868 a bill was carried through the French chambers which raised the force of that country, nominally, to 800,000 men. The term of service was increased from seven to nine years. The rate of recruiting per annum was fixed at 100,000 men, selected by conscription; the proportion of which to the population (37,000,000) being about 1 to every 370. The nine years' service men were divided (as regards the 70,000 men who were called for service out of the 100,000) between five years passed under the regimental colours and four years in a general reserve, called the second reserve. The remaining 30,000 men were enrolled in the first reserve, and were not required to perform any military service in peace-time, except five months' drill in each of the five years. Those who were not drawn by conscription had to serve five years in the *garde mobile*, being called upon to take the field on emergency.

Such was the military system of France when the war of 1870–71 broke out. It proved inefficient to produce a trained second reserve; and in order to insure the French army an ample and constant supply of recruits, the law of general military service of the First Republic was restored in its fullest vigour, in a bill passed by the French assembly in July 1872. The present system alters entirely the military recruiting of that country, and is similar to the German one, as will be seen by the following principal clauses:—

Every Frenchman is liable to military service, and must serve personally, the system of substitute being abolished.

He is called upon to serve from the age of 20 (instead of 21, as by the former law) to the age of 40, the period of service being thus distributed:—

Five years in the active army;
*Four* years in the reserve of the active *army;*
Five years in the territorial army;
Six years in the reserves of the territorial army.

Every man enrolled in each yearly contingent has to serve for twelve months at least, except those for the service of special arms—artillery, engineers, and cavalry, which require a longer training—and they have therefore to serve a much longer time.

Notwithstanding all permanent exemption being abolished, there are certain strictly determined cases of a temporary kind, which exempt men from the service, such as: supporters of families, eldest brother of orphans, only son or grandson of widows, &c. Young men who have obtained university and college degrees, and those who belong to government schools, and who desire to continue their studies, may volunteer for one year. They are called *volontaires d'un an*. The men of this class must defray at their own expense the cost of their uniform, equipment, and horse, if in the cavalry. After one year they have to pass an examination, and, if not successful, have to remain another year in the ranks. At the end of their term, they receive, as a rule, certificates of qualification as non-commissioned officers or officers in the territorial army. Like all others, they are liable to be called upon to serve on the outbreak of war.

The rate of recruiting by this new law is computed to give France a yearly contingent of 150,000 men, deductions being made on occount of the "dispensed with" class. Each contingent is therefore, in different ways, subject to serve for twenty years, and consequently at the end of that period the forces of France will amount to an aggregate of twenty contingents of 130,000 each, with deductions for deaths and casualties, giving a total of 2,423,164 men.

In addition to these levies, France has a permanent army of 81,722 men, belonging to the permanent effective, not recruited by means of the conscription, composed of officers, staff, administrative corps, *gendarmerie*, &c.

The active army in time of peace has (1875) a strength of 480,000 men, and in time of war, by calling in the trained contingents of 780,000 men, organised in corps, and ready to take the field at once on the outbreak of a war, has behind it "troops of reinforcement" amounting to 279,000 men, who have all served at least one year in the army. These "troops of reinforcement" will be distributed in the corps depots, together with the 150,000 men of the last class called up and not yet fully instructed.

Thus the fighting army of 780,000 men may be increased by 429,000 men ready to fill up vacancies in the fighting corps.

The organisation of these forces was the subject of a bill passed by the assembly, and promulgated in March 1875; it is known as the *Loi des Cadres.* By this law, France is divided into 18 military regions, each garrisoned by an army corps, besides a special corps (19th) for Algeria.

Each army corps has 2 infantry divisions, 1 brigade of cavalry, 1 brigade of artillery, 1 battalion of engineers, and 1 squadron of field train, besides staff and auxiliary services. The several army corps are recruited indifferently from the whole contingent, and during peace may be moved from region to region; but the reserves are organised in their own regions. On the outbreak of war, the men of the reserve will be mobilised near their homes, clothed and armed at depots already known to them, within a day's walk, and sent to swell the ranks of that corps which happens to be stationed in the region at the time. The territorial army will, at all times, belong to its own region. Its duties in war will be to garrison fortresses, defend strategic points, work the lines of communication, and set the active army free for field operations, but, if urgent, will also cooperate in the field with it.

The French army is composed as follows: — 144 regiments of the line, each regiment consisting of 4 battalions, and each battalion of 4 companies, with 2 depot companies; 30 battalions of foot *chasseurs* (*chasseurs à pied*), each battalion of 4 fighting companies and 1 depot company.

In addition, the 19th *corps d'armée*, quartered in Algeria, comprises:—

Four regiments of *zouaves*, each regiment of 4 battalions, consisting of 4 fighting companies and 1 depot company.

Three regiments of Algerian sharpshooters (*turcos*), organised like the *zouaves.*

One foreign regiment of 4 battalions, each 4 companies strong.

Five discipline companies (*zéphyrs*).

Each fighting company consists of 1 captain, 1 lieutenant and 1 sub-lieutenant, 1 sergeant-major, 4 sergeants, 1 quartermaster-sergeant, 8 corporals, 2 drummers or buglers, and 66 privates; total per company on peace footing, 3 officers and 85 rank and file. At 16 companies per regiment, this gives an aggregate of 48 officers and 1312 rank and file. The two depot companies present an effective of 6 officers, 32 non-commissioned officers, and the number of men remains unknown. On the war-footing, each company is increased by 1 lieutenant or sub-lieutenant, 1 quartermaster-corporal, 4 sergeants, 8 corporals, and 2 drummers.

The cavalry branch of the service consists of 77 regiments, viz.: 12 regiments of cuirassiers, 26 regiments of dragoons, 20 of *chasseurs*, 12 of hussars, 4 of *chasseurs d'Afrique*, and 3 regiments of *spahis* (native cavalry of Algeria). The 70 home regiments form 18 brigades of 2 regiments each, one of which is attached to each *corps d'armée.* This leaves 34 regiments available to form independent cavalry brigades and divisions. Each of the 70 home regiments consists of 5 squadrons, having on peace footing 45 officers, 830 men, and 740 horses. The African regiments are 6 squadrons strong, and their effective amounts to 59 officers, 978 men, and 930 horses. In addition there will be 19 squadrons of cavalry volunteers, who will supply the generals and staff officers with men capable, from previous instruction, of performing, efficiently, duties as guides, escort, orderlies, &c.

The artillery consists of 38 regiments quartered in France, forming 19 brigades, 2 per army corps. The first regiment of each brigade consists of 3 batteries *à pied* (without guns), 8 batteries *montées* (with guns), 2 *montées* depot batteries (provided with guns for drill and practice purposes); in all 65 officers, 1349 non-commissioned officers and men, and 635 horses. The second regiment of each brigade consists of 8 mounted batteries, 3 batteries of horse artillery, and 2 mounted depot batteries; 68 officers, 1369 men, and 878 horses. There are 2 regiments exclusively entrusted with the bridge and pontoon department, 10 companies of artillery artisans, 3 rocket companies, and 57 companies of the artillery train.

The engineering department consists of 4 regiments of sappers and miners, and that of the military train of 20 squadrons.

Besides the above forces, there are certain auxiliaries, viz.—military clerks and artisans; ambulance staff and attendants (*infirmiers militaires*); military chaplains; the *gendarmerie* and a regiment of firemen of the city of Paris, who are picked men from the army; a corps of military interpreters, a telegraphic staff and corps, a railway staff and corps, the three latter being borrowed from the German system. The various railway lines in the rear of the army are to be worked by these corps, under military superintendence in front of the lines. To secure a competent military railway staff, a certain number of sappers and miners, after one year's service with the colours, will be told off to the various railways to complete their professional instruction.

The mode of officering the French army is partly from the ranks, partly from the military colleges, specially from the latter.

Major Brackenbury, in the preface to his translation of the law on the general organisation of the French army, adverts to the subject of the principles on which it has been remodelled, as follows:—

"1st. General obligation to military service.

"2nd. A peace organisation approaching as nearly as possible the organisation for war. The corps are always ready with their staffs and administrative services, and only require the addition of their reserves—always close at hand—in order to take the field. Their stores are also on the spot.

"3rd. Decentralisation. Each general mobilises his own corps, is responsible for his own first supplies, and can have no one but himself to blame if he is slow or wants anything.

"4th. On the other hand, the government has a corps of inspectors, who will during peace detect the incompetence of a commander.

"5th. The control is carefully separated from the administration, and the generals are expected to be good administrators as well as good leaders of troops.

"6th. Recruiting, remounts, hospitals, &c. are managed by the territorial staff in each region, but always under the general commanding the corps then present. When a corps is mobilised and quits its region, the command of the region and its territorial troops is handed over to an officer previously appointed by the minister."

In order to act up to the spirit of the new law, the war office has been reconstituted under conditions more in accordance with the organisation of the army; and the department of the chief of the general ministerial staff comprises now a ministerial cabinet and 5 bureaux, namely:—

First bureau: general organisation and mobilisation of the army; positions and strength; general correspondence.

Second bureau: military statistics; historical office.

Third bureau: military operations; instruction of the army; topographical office.

Fourth bureau: *Etappen* and railway service; execution of movements of troops; transport of troops by land and sea.

Fifth bureau (or war depot): technical services; collections; material and accounts of the general staff.

Two deputy chiefs of the staff are attached to the chief of the staff. (*Vide* Appendix C.)

**French Rifled Gun**—A bronze muzzle-loading piece. There are three light guns in the service, a 4-pr., 8-pr. and 12-pr., each having six grooves. The French artillery may be said to be in a transition state. Experiments for some time past have been carried on, the result of which has been satisfactory to steel breech-loading rifled guns of the

Reffye system. The heavy guns of the service are made of cast iron, hooped with steel, and having a steel tube. They are B.L.R. guns. It is not unlikely that a steel gun will be introduced into the French service.

The French system of gun rifling is thus described in the 'Treatise on Ammunition for 1874':—"The bottom of the groove is concentric with the bore, the driving edge making an angle of 70°, with a radius to the centre of the bore, and the loading edge an angle of 56°. The studs are made of a shape corresponding to the grooves. The driving edge of the groove is an easy inclined plane, up which the stud mounts, so as to centre the projectile." (*Vide* Centring.)

This system of rifling has been adopted for the field guns of the British artillery, and in a modified form it has been applied to the heavy guns, giving rise to the name of the "Woolwich guns." In 1865, after several experiments with the different heavy guns, the then Ordnance Select Committee recorded their unanimous opinion in favour of the so-called French system over other systems. Amongst other advantages recorded was the simplicity of the grooving of the gun, which led to its being adopted.

**Friction**—Is "the resistance which bodies experience when rubbing or sliding on each other, or the resistance in machines caused by the contact of different moving parts. By the aid of lubricants, friction may be reduced to a certain extent, but can never be thoroughly got rid of. Friction manifests itself in many different ways according to the kind of motion one surface has upon another, and is proportional to the pressure; that is, everything remaining the same, the friction increases as the pressure increases."

An instance of friction is seen in gunnery in the resistance offered to a projectile in its passage through the bore of a gun, which varies in intenseness in smooth-bore and rifled guns. In the former, from the bounding of the shot, caused chiefly by windage, the resistance from friction is comparatively small; but in rifled guns, firing elongated shot which have no such movement as alluded to, *it is consider*able, from the shot cleaving closely to the grooves. Colonel Owen shows that this friction is chiefly dependent "upon the weight of the projectile and on the nature of the materials used respectively for the bore and the stud of the projectile, or other part in contact with the metal." What has been stated will be sufficient to show what takes place within the bore of a gun.

The next instance is that which occurs in draught, a subject, like the former, particularly interesting to that part of our army to which the transport by carriages or carts of the material of war is committed, and especially to the artillery.

"In draught, there are two kinds of friction opposed to the movement of a carriage:

"1st. That of the arms of the axle-tree in the naves;

"2nd. That of the felloes upon the ground.

"The more the causes producing these two kinds of friction are attenuated, the easier will be the movement of the carriage. With reference to the first kind of friction, take two wheels of different heights, having axle-tree arms of the same diameter, the friction will be in the inverse ratio of the height; that is to say, wheels of 2 feet in diameter experience double the friction of wheels 4 feet in diameter, equal in all other respects; consequently the higher the wheels are, the less the friction will be in their naves. In two wheels of the same height having axle-tree arms of different diameters, the friction in the naves is in direct ratio of the diameter of the arms; that is to say, an arm of 4 inches diameter will experience double the friction of an arm 2 feet in diameter. Therefore the thinner the axle-tree arms are, the less will be the friction in the naves. In two wheels of different heights, having axle-tree arms of different diameters, the friction will be in inverse ratio of the quotients of the heights of the wheels divided by the diameters; for instance, should one wheel be 50 inches in height, diameter of axle-arm 5 inches, and the other 60 inches in height and 2 inches in diameter, the friction experienced by the former will be to that of *the latter* as $\frac{60}{2}$ to $\frac{50}{5}$, or as 3 to 1.

Therefore to facilitate 'draught,' wheels must be made as high, and axle-tree arms as thin, as possible. The friction in naves depends principally upon two things:

"1st. The weight bearing upon the axle-tree;

"2nd. The kind and quality of the materials of which the axle-tree and interior of the naves are formed.

"The second kind of friction presents two cases, viz., 1st, when the ground upon which the carriage moves is *horizontal*, but sandy, muddy, or rugged; 2nd, when ground of the same nature as in the former case makes, likewise, an inclined plane."

**Friction Plate**—A plate of iron placed on the side of the trail beam of wooden gun carriages, at that point where the wheel locks with the carriage. The plate is placed in that position to prevent injury to the trail when the limber is being turned at a sharp angle to the gun carriage.

**Friction Tubes**—Small copper tubes filled with composition, which are used in discharging guns in lieu of priming powder. There are three kinds:

The *short* friction tube (about 2 inches long) for the 7-pr. M.T. gun;

The *long* friction tube (about 5 inches long) for 10-inch M.L.R. guns and upwards;

The *ordinary* friction tube (about 3 inches long) for all other guns.

These tubes are filled with closely tamped mealed powder, having a vent hole down the centre of the composition. Near the top of the tube a hole is bored through the copper, in which a small cylinder of copper is fastened, which contains the detonating charge, and which communicates with the main portion of the composition by a hole bored into the composition tube. In this small cylinder a rubber or friction bar of copper is inserted, having an eye on its outer extremity; above and below this bar, a small pellet of detonating composition is placed, and the tube is then firmly compressed together with pincers. The finished tubes now receive a coating of black varnish, and a coating of paint, and finally another coating of varnish; *they are then dried* in a steam bath. By this means the joints of the tube are rendered impervious to damp. To ignite the tube, a lanyard (*q. v.*), with a hook attached, is placed in the eye of the friction bar and steadily pulled.

The action of friction tubes, when new, may be said to be very certain, but after having been ten years in store, they are not to be depended upon.

**Frog**—A horny wedge-shaped substance within the cavity of a horse's hoof. The function of the frog is to share in the pressure on the foot, and by its elasticity to relieve or distribute the pressure on the hoof.

The name is also given to that part of a soldier's accoutrements which is attached to the waist-belt for holding the bayonet.

**Front**—As opposed to rear. The front, with reference to an alignment, is the direction of the supposed enemy. Used as a general term, the word signifies the direction in which soldiers face when occupying the same relative positions as when last told off. The front in artillery is the direction to which the horses' heads turn when the battery is limbered up.

**Front of Fortification**—Comprises all the works constructed on any one side of the polygon which surrounds the ground to be fortified.

**Frontage**—This term is expressive of the ground troops in line occupy either on parade or in camp.

Cavalry in one line requires one yard to each file, and 12 yards between squadrons. Artillery in line, whether a field or horse artillery battery, occupies 95 yards, and 19 yards between battery and battery, or between other troops.

The frontage required by infantry is 2 feet per file, with intervals of 30 paces between battalions.

In camp, the frontage, as a general rule, of cavalry and infantry should, as is shown in the 'Soldier's Pocket-book,' "correspond with the space covered by the regiments when deployed into line (allowance being made for intervals between corps), and the lines of tents should be on the prolongation of the squadrons or companies as they stand when in column."

"When troops are encamped in two or three lines, from 200 to 500 yards should be left clear between the rear of one line and the front of that behind. The frontage of a battalion of infantry in camp on war establishment occupies 320 yards, a regiment of cavalry 256 yards, and a battery of artillery 110 yards."

**Fuel**—Any combustible substance to feed a fire, such as wood, coal, &c.

The fuel issued by the commissariat to troops for cooking their food is either of wood or coal, 3 lbs. to each man; if the latter be supplied, a small quantity of kindling wood is also issued. On service, if wood be in abundance in the surrounding country, the troops will be independent of the commissariat, and will gather it themselves, parties being formed, each under an officer for that purpose. In India the ration fuel is always of wood.

**Fugleman,** or **Fugelman** (German, *Flügel,* a wing) — A soldier formerly placed in front of a regiment to give the time in the manual, platoon, or sword exercise. This man was the *fugleman,* and he was generally posted in front of the right wing.

**Fulcrum**—The point of suspension in a balance, or axis of a lever on which the arm of the scales is balanced. Levers are of three kinds, in each of which the position of the fulcrum depends upon the relation of the power to the weight. (*Vide* Lever.)

**Full Charges**—In artillery, are the ordinary charges used with rifled projectiles. The powder used for full charges of 40 lbs. and upwards is P. powder, and for all charges under 40 lbs. L.G. powder. (*Vide* Battering Charges.)

**Fulminate of Mercury** ($2H.G.OC_4N_2O_2$) —A salt of mercury with fulminic acid. It is used in the manufacture of percussion caps; also in the preparation of the E. time, R.L. screw, and B.L. plain percussion fuzes. It is of a highly explosive nature, and formed from the combination of mercury and nitric acid, mixed with chlorate of potassa. The process pursued in the manufacture of this composition is as follows:—

| | |
|---|---|
| Take of mercury .. | 7 oz. 12 drs. |
| „ „ nitric acid .. | 4 „ 4 „ |
| „ „ alcohol .. | *4 lbs. 8 oz.* |

Mix these ingredients together in a glass retort, exposing them for a short time to the action of the sun; then place the neck of the retort into a receiver, being careful to close, securely, the point of junction with clay, so as to prevent any escape of the vapour arising from the chemical action of these ingredients. This action will be seen to commence shortly after, by thick white vapour being thrown off through the neck of the retort into the receiver, where it becomes condensed. As soon as this action of the ingredients ceases, the retort is removed, and at the bottom of it will be found a residuum, which is fulminate of mercury. This is taken out of the retort and washed thoroughly with distilled water, until all trace of acid be removed. This is known by dipping litmus paper into the washings, when, if free from acidity, the paper will not change colour, or when the water becomes tasteless. The fulminating powder is then dried, not in the sun, but on sheets of longcloth, in a room, spread on trays of wicker or brass work. When dried, it is packed away in small parcels; and the reason of this is, that from its explosive character it would be dangerous to heap it together in any quantity. When required for use, it has to be mixed with chlorate of potassa and antimony in the following proportions:—

| | |
|---|---|
| Chlorate of potassa .. .. | 6 oz. |
| Fulminate .. .. .. | 6 „ |
| Antimony .. .. .. | 4 „ |

It is then mixed with a soft hair brush, and sifted in a fine brass sieve to which a leather bottom is attached.

Fulminate of mercury detonates either by a blow or at a heat above 370° Fahr. It detonates in a moist condition, and in a dry state explodes readily when struck or even when harshly rubbed.

**Funeral, Military**—The interment of officers, non-commissioned officers, and soldiers. What are termed funeral honours, such as are laid down in the Queen's Regulations, are only to be accorded to officers who at the time of their decease are on full pay, or employed on the staff of the army, or in the exercise of any military command. Non-commissioned officers and soldiers receive funeral honours, as laid down in the regulations quoted.

**Furlong**—Eighth of a mile; forty rods.

**Furlough**—Leave of absence, granted to officers and soldiers of the army, and to members of the civil service. The term furlough is very generally used in India, when a servant of the government proceeds on leave out of the country. The period of furlough granted to officers of the Indian army, and to officers of the imperial establishment on the staff, is as follows. After 8 years' actual service in India, 2 years. On the completion of 6 years' further actual service, after return from Europe, an officer is eligible for a third year's furlough, and for a fourth or fifth year after similar intervals of 6 years.

Warrant officers are granted leave to Europe after 6 years' service in that rank, and after 15 years' service in India, according to the old rules of the service. In 1868 new rules were issued on the subject of leave to this class of officers, who entered the service after that date; but they were applicable also, at option, to those in the service before that date. Warrant officers holding veteran or honorary commissions can, if they have elected the rules of 1868, enjoy the same privileges as to furlough as commissioned officers.

The furlough pay is as follows:—An officer drawing staff pay in addition to the pay of his rank is allowed 50 per cent. of his substantive appointment. This has been somewhat modified, and in no case can the absentee now draw more than £1000 per annum.

Officers not on staff employ in India receive half the Indian pay of their rank, and in no case are to receive less than the minimum of £250 per annum. Short leave, for a period not exceeding 3 months, is given in the country, or elsewhere, to officers in general; *privilege leave* is granted to all officers for 60 days, and to those in far distant districts for 90 days, without loss of pay and allowances; beyond that period, staff officers receive only half staff allowance.

**Furnace**—In the general acceptation of the term, any vessel or utensil for maintaining a strong and searching heat, either of coal or wood.

***Furnace, Reverberatory***—A furnace in which metal ores are roasted or calcined. The principle of such a furnace is this, that a flame shall be produced, and reverberated or reflected down upon the mineral; this is usually done by burning a bituminous fuel in the grate, and the flame thus produced is reverberated upon the ore, by the peculiar form which is given to the vaulted top of this kind of furnace, and also by the draught excited by a tall chimney. This is the kind of furnace used in a foundry where guns are cast, or metals are melted.

**Fusil**—As described in the 'Musketry Handbook for Hythe,' "a firelock lighter than the musket invented in France about 1635, and deriving its name from the Italian word *focile*, 'a flint.' In 1678 a British regiment was armed with the fusil, and the king added a company of men armed with hand grenades to each of the old British regiments, which was designated the grenadier company."

**Fusilade**—A general discharge of fire-arms.

**Fusilier**—Formerly, a soldier armed with a shorter and lighter musket than the rest of the army, which he could sling over his shoulder.

The fusilier regiments, of which there are ten in the British service, are not distinguished from the infantry of the line as they formerly were; the title is now purely honorary, and they are armed and dressed in every way like the line regiments, except in the head-dress and in the mode of wearing their chevrons. The head-dress of the officers is a busby, the material of which is made of racoon skin, for that of the non-commissioned officers and of the men, of sealskin. On parade, or marching in quick time, upon occasions of guard-mounting parade, or review, they march to the Grenadiers' March.

**Futchels**—Are strong pieces of wood or iron, three in number, uniting the splinter bar and the axle-tree bed of a gun carriage or limber.

**Fuze**—An invention for igniting the bursting charge of a shell at any particular time or object.

There are two descriptions of fuze in the service, time and percussion; the former made of wood after General Boxer's pattern, which is used when it is required to burst the shell at any particular moment of time, hence its name, *time fuze;* the latter, of which there are different patterns, is used when it is desired to burst the shell on impact.

Time fuzes are used with all natures of shell fired from smooth-bore and rifled ordnance. The principle on which the different natures of the Boxer fuze are made is very similar; some little difference exists in the capping and priming the fuze, and in the mode of conducting the flame to the fuze composition.

There are three lengths of time fuzes, independent of those for mortars, designated according to the length of time they burn, viz. 5, 9, and 20 seconds. The composition burns at the rate of 1 inch in 5 seconds. Each fuze has the number of quarter seconds, half-seconds, and seconds, painted on it, according to the nature of the fuze. The 5-second fuze, for instance, reads to quarter seconds, the 9-second fuze to half-seconds, and the 20-second fuze to seconds. As explained in the 'Treatise on Ammunition, 1874,' it is essential in firing shrapnel shell from field guns to have a fuze which acts at short intervals of time, and for this reason: "Suppose a shell to be flying at the rate of 1200 feet or 400 yards a second; in this case the space corresponding to half a second is 200 yards; it is evident that, to develop the full powers of shrapnel shell, we should have a fuze which can be bored to act at shorter intervals than half-seconds. Hence the advantage of the 5-second fuze, which can be made to act at intervals of quarter seconds, corresponding to 100 yards in flight." These minute divisions are not essential in the 20-second fuzes, as the shells with which they are used are fired at long ranges, and consequently to bore into the composition at less than one second would be unnecessary.

The conditions to be fulfilled in time fuzes are thus explained by Lieutenant-Colonel Owen, in his treatise on 'Modern Artillery':—

"(1) That they should ignite with certainty; (2) that they should burn regularly; (3) that, when ignited, they should not be liable to extinction *on striking earth, water, or wood.*"

With reference to the latter condition, a time fuze is very likely to act as a percussion fuze if the shell hits any hard substance, point on.

The *percussion fuzes* in the service are known as Pettman's, for land and general service—the *C cap* percussion fuze, the nomenclature of which has been changed to *Fuze, percussion, breech-loading, plain;* and the R.L. percussion fuze. The two latter are the only fuzes which can be relied on to act on graze. The B.L. *plain* fuze, is used with Armstrong, field-service, B.L., common, and segment shell; the R.L. percussion fuze with all rifled M.L. shells, up to the 80-pr. inclusive, and with all B.L. shell having the G.S. fuze hole.

The essential requirements of a good percussion fuze are, as further stated by Lieutenant-Colonel Owen: "(1) That it shall not be ignited by the shock of discharge; (2) that it shall be ignited on the impact of the shell 'against the object'; (3) that it may not be liable to explode during transport; and (4) that for naval service it shall not explode on striking water."

The use of percussion fuzes is thus explained in the 'Treatise of Ammunition, 1874': "Percussion fuzes are employed for two distinct purposes: they are used in shells intended exclusively to act against solid obstacles, such as earthworks, brick walls, or wooden ships; and they are also used in shells employed against troops in the field, as well as in shells directed against buildings and material generally.

"For the first purpose, it is desirable that the fuze should only act on direct impact, and a very instantaneous action is not required. It will be seen that the Pettman G.S. percussion fuze is specially designed to act only on direct impact.

"For the second purpose, when used against troops in the open, it is necessary the fuze should act on graze, and that it should act almost instantaneously, as otherwise the shell has time to rise to a considerable height before bursting, and thus its effect against troops is diminished. Such an action is secured in the R.L. screw and B.L. plain percussion fuzes." These, with the Pettman L.S.

and G.S. fuzes, are the only percussion fuzes in the service.

In writing on the subject of fuzes, it may be as well to mention that it has been discovered in high trajectories, such as in mortar practice, that the pressure of the atmosphere being less than when near the ground, the fuze does not burn so quickly. From experiments made, it appears that each diminution of 1 inch of barometrical pressure causes a retardation of 1 second in a 6-inch or 30-second fuze, or each diminution of atmospheric pressure to the extent of 1 mercurial inch increases the time of burning by one-thirtieth; or, in other words, the increments in time are proportional to the decrements of pressure.

Quartermaster Mitchell, R.A., first brought this fact to notice, and it has subsequently been confirmed by Dr. Frankland, F.R.S., 'Proceedings of the Royal Society,' vols. x. and xi. (*Vide* Appendix B.)

**Fuze, Bickford's**—A fuze used in mining and for submarine purposes. It consists of a very small tube of strong linen filled with gunpowder, and served round with tarred twine, and the whole pitched over, which renders it waterproof. There are about nine kinds of this nature of fuze, which vary in the amount of protection given to the linen or flax according to the purpose required of them; if for sub-aqueous blasting, the fuze is covered with gutta-percha. The tubing is procured in coils like small rope, and keeps very well. It burns at the rate of about 1 yard in 70 seconds. Mines are usually fired, or, as it is technically termed, sprung, by a powder-hose or by Bickford's fuze, the latter being ignited by a detonator.

**Fuze, Electric,** *vide* Electric Fuze.

**Fuze Hole**—The perforation made in a shell for holding the fuze. To render the fuze holes of shells, having the Moorsom gauge, capable of receiving the G.S. fuze, an adapter (*q. v.*) must be used.

## G.

**Gabion** (Italian *gobbia*, hollow)—A cylindrical basket, open at top and bottom, used for revetting the interior slopes of a battery and other field works. It is 3 feet high, 2 feet in diameter, and weighs 40 lbs. There are three kinds of gabions in the service—the wicker, Tyler's sheet iron, and Jones' iron band gabions. They are described as follows:—

"*Gabions, Wicker.*—Open cylinders, of coarse basket-work, 2 feet 9 inches high, 1 foot 9 inches or 2 feet 9 inches in diameter; the smaller for saps, the latter for batteries; no larger size should be made. Having set twelve pickets, each ¾ to 1 inch in diameter, in a circle, begin by inserting the ends of three rods between three consecutive pairs of pickets, then weave them in and out, round the circle, taking care that they pass alternately over and under one another, and to carry each in turn outside *two*, inside *one* picket. Each squad of three men requires one bill-hook, three gabion knives, one 4-foot rod, one chopping block, one 3-foot line, and sometimes a hand saw. The rods for the web should be from ⅜ to ¾ inch in diameter, of the most flexible material to be procured, and stripped of fine branches. Three men turn out a 2-foot gabion in two hours; weight from 36 to 40 lbs."

In India, the bamboo is the best wood for gabions; whole bamboos being used for the uprights, and split ones for weaving round them. They are very easily and quickly worked up.

"*Gabions, Sheet Iron, Tyler's.*—A single sheet of galvanised iron, about 0·45 inch thick, 75½ inches long, 36 inches wide, with four eyelet holes, weight 26 lbs., requires no pickets. The sheet is rolled into a cylinder for use; the ends secured by strong wire ties. The noise which is made by the gabion when carried empty is a drawback from its general advantages. The sheets may be used for roofing and other purposes."

Two men can make one of these gabions in ten minutes.

"*Gabions, Iron Band, Jones'.*—Each

gabion is made of ten bands of galvanised sheet iron, worked over twelve wood pickets, the ends brought together and connected by two buttons at one end, fitting into two slots at the other. Each band is 77 inches long, 3¼ inches wide, of No. 20 gauge, or about 0·05 inch thick; weight of ten, 29 lbs. The buttons and buttonholes are required to stand a weight of 672 lbs., the band itself will support about 1500 lbs.; each band has four holes to admit of combination to form bridges, beds, stretchers, and for other incidental applications: little or no instruction is required for making these gabions."

Two expert men can make a gabion in five minutes.

*Gabion Trip for Cavalry.*—The bands of Jones' iron gabions may be formed into a network as an obstacle against cavalry and even against infantry in night attacks. The bands are buttoned and placed in line 3 or 4 feet apart; each band is connected with the next by stout wire or rope passed through the binding-holes. Bands thus connected should be laid in parallel rows, chequerwise, 3 or 4 feet apart, the rows also connected by wire or rope and secured at intervals to pickets driven into the ground.

*Sebastopol Hoop-iron Gabion.*—This gabion was made of hoop-iron during the siege of Sebastopol. The iron was obtained from the iron hoops used to secure the bales of clothing, trusses of compressed hay, &c. Three men could make a gabion in an hour. The weight was about 30 lbs.

In the 'Manual of Field Fortification, &c. of 1871,' published by authority, it is stated as follows:—"Of all the various kinds of gabion here mentioned, the most useful for battery purposes is the wicker gabion, as it is found to stand well in the cheeks of embrasures, and is free from the danger of splintering which is the great fault of all iron gabions."

**Gads,** or **Gadlings**—An old Norman name given to that part of the gauntlet which covers the knuckle, and which was armed with knobs or spikes of iron. In a trial by combat adjudged between John de Visconti and Sir Thomas de la Marche, fought before Edward III. in close lists, at Westminster, Sir Thomas de la Marche gained the advantage by striking the gadlings of his gauntlet into the face of his adversary.

**Gages, Common**—Tools for setting out lines and grooves parallel with the margin of the carpenter's work. The "stem" of the gage is retained in the head or stock by means of a small wedge, and the cutter is fixed in a hole at right angles to the face of the stem by another wedge. There are several forms of gages, such as the *marking*, *cutting*, *router*, *mortise gage*, &c.

**Gaining Twist**—Some of the rifles and rifled ordnance in the service are made with grooves which have a very slight twist at the breech, but the twist is increased regularly until it reaches the muzzle; this is known as the *increasing* or *gaining twist*. At the instant of discharge, when the shot, from a state of rest, is instantly given a high velocity, it would seem likely to be pushed across the grooves, especially if they have a great inclination. To avoid this, the inclination of the grooves is made slight at the breech, and increased gradually toward the muzzle, at which point they are sufficiently inclined to give the necessary rotatory motion. In the increasing twist, though the projectile leaves the seat or chamber of the gun with great velocity, and relieves the breech a good deal from the strain of the discharge, its velocity is less than from a gun with *uniform twist*.

**Galena,** or **Sulphide of Lead**—Is the most abundant ore of lead known. It is found in different parts of Great Britain and the continent of Europe. It has usually a metallic lustre, or a leaden grey or blackish grey colour, and its structure is lamellar. The principal varieties of this mineral are specular galena and blue lead. It is used in the laboratory, and forms one of the ingredients in the composition of blue lights.

**Gall**—The wound inflicted on draught or riding horses from the imperfect fitting of the harness or saddle. Saddle galls are the most common. For the prevention of galls, *vide* Pad.

**Galleries**—In military mining, are the excavations formed underground from the end of the shaft, to enable the miners to reach the required positions for placing the charges; they are called *shafts* when vertical, and *galleries* when horizontal or slightly inclined, the latter being distinguished as *ascending* and *descending*. What are termed *great* galleries are those used in the attack of a fortress, for descending from the crowning of the covered way into the ditch. In a system of countermines, the gallery, which runs parallel with the counterscarp, and is the base of the system, is known as the *magistral* gallery; that which is parallel to it, and beyond it, is the *envelope* gallery; those that connect these parallel galleries are *galleries of communication;* and all those pushed into the country, beyond the envelope gallery, are *listening* galleries.

**Gallop**—The quickest pace of a horse; in cavalry manœuvre, it is about eleven miles an hour or upwards.

**Galloper Guns**—Light guns of small calibre. Formerly, these guns were attached to infantry regiments, but they have long been abolished.

**Galvanic Tube**—This tube has been superseded by Abel's electric tube (*q. v.*).

**Galvanised Iron**—Iron covered with a coating of zinc, either by the electro process, or by the application of an amalgam of zinc and mercury to the surface of chemically cleaned iron. The latter is called Mallet's patent process.

**Galvanism**—A branch of electricity, named from Galvani, an Italian, in which electrical phenomena are exhibited without the aid of friction, and a chemical action takes place from the contact of certain metallic and other bodies. The subject was subsequently treated by Volta, and has since been denominated indiscriminately galvanism or voltaic electricity. Galvanism is much used in the arts.

**Gambesan**—Clothing of stuffed and quilted cloth, which was sometimes used to cover war-horses during the middle ages. It was also a garment worn in the twelfth and thirteenth centuries by those who could not afford hauberks.

**Gardens, Military**—Gardens sanctioned for the employment and amusement of troops both at home and abroad. In India the produce of the soldiers' gardens is bought by the commissariat department, and issued as part of the soldiers' rations. The Queen's Regulations give the rules and regulations attending the cultivation of gardens in Great Britain.

**Garlands,** *vide* Shot Garlands.

**Garnish Plate**—That part of the iron work of the O.P. gun carriage which covers the upper surface of the brackets.

**Garrison**—The troops left within a fortified place for its protection, or merely as ordinary quarters.

The proportion of men laid down for the protection of a fortress has for its object, first, the number required for the immediate security of the place, and, secondly, that required to sustain a siege; an arrangement which in peace avoids the necessity of shutting up a considerable body of troops without an immediate object.

For the immediate security of the place, 350 infantry, 10 cavalry, 60 artillery, 20 sappers (= 440 per bastion) might be required, and in anticipation of a siege, double that number; for the fronts susceptible of attack, surplus arms at the rate of 1 for every 4 men; wall pieces, 10 for each front; musket ball ammunition, 500 per man; hand grenades, 10 per man; gunpowder in barrels, 2½ lbs. per man, inclusive of that required for the artillery and engineer services, ought to be provided.

Of the 151 line battalions composing the garrisons at home and abroad, 60 are stationed in India, 20 in the colonies, and 71 at home; thus allowing one battalion at home and one abroad for each brigade. The chief foreign garrisons are Malta (7 battalions) and Gibraltar (5 battalions). The largest home garrisons are London (for the guards), Portsmouth, Dublin, Cork, Plymouth, Chatham, Dover, and the camps at Aldershot, Colchester, Shorncliffe, and the Curragh.

**Garrison Artillery**—Comprises the ordnance placed on the works of a fortress, having either a land or sea front, and the men for working the guns. The ordnance used in such positions are for the most part heavy artillery, rifled and smooth-bore, of different natures and sizes, but the latter are gradually being replaced by rifled guns. The class of guns placed under the head of garrison artillery for land fronts comprises the

64-pr. M.L.R. and the 7-inch B.L.R. guns; also the Palliser converted guns, namely, the 80-pr., the 64-pr. and the 56-pr. M.L.R. guns. These guns have been converted from our cast-iron S.B. guns, from the 24-pr., upwards. The guns for sea fronts are of a heavier nature, and comprise the 7-, 9-, 10-, 11-, 12- and 12½-inch guns, of the respective weights of 7, 12, 18, 25, 35, and 38 tons. The 81-ton gun, which has lately been constructed, may eventually be used for coast defence.

**Garrison Carriage**, *vide* Carriage.

**Garter, Order of the**—A military order instituted by King Edward III.; though not the most ancient, it is one of the most famous of the military orders of Europe. In Colonel Luard's work it is remarked that "the circumstance that suggested the choice of this symbol is as great a mystery as the origin of the Prince of Wales plumes; the popular tradition which assigns it to the accidental fall of a lady's garter is pretty generally rejected; yet, as it does not appear that gentlemen wore garters at that period, it seems probable that the old tale may have been true." The well-known emblem of the order is a dark blue ribbon edged with gold, bearing the motto, *Honi soit qui mal y pense*, in golden letters, with buckle and pendant.

**Gas**—An aëriform fluid, but differing from the air of the atmosphere. The gas used for inflating balloons with is common coal gas, the specific gravity of which is 0·4, common air being 1·0. When this is not procurable, as, for instance, in the field, where balloons might be required for military purposes, hydrogen gas should be used, which is procured by passing steam through iron cylinders, charged with iron turnings, and heated to redness in some simple kind of furnace. By this means the steam is decomposed, its oxygen uniting with the iron, while the hydrogen is disengaged. The latter should be passed through a reservoir of caustic lye before it enters the balloon.

The gas produced by the explosion of gunpowder consists of carbonic acid, carbonic oxide, nitrogen, the sulphide, cyanide, and sulphocyanide of potassium, carbonate of potash, hydrosulphuric acid, bisulphide of carbon, and aqueous vapour. Its temperature is estimated at 2192° Fahr., and its volume at that temperature is more than 2000 times that of the powder.

**Gasket**—In artillery, a flat plaited cord used for "stoppering the fall." It may also be made (on the same principle as the *selvagee*) by placing the same number of rope-yarns in a straight line and marling down.

**Gates**, *vide* Barriers.

**Gatherers**—The fore teeth of a horse.

**Gatling Gun**—One of the many types of mitrailleurs which has been invented of late years. This weapon is the invention of Dr. Gatling. His 0·45-inch mitrailleur has been introduced into the British service after undergoing considerable improvement. From experiments made with this gun, 657 shots have been discharged in two minutes. It is thus described in the 'List of Changes in War Material':—

"There are ten locks corresponding to the ten barrels. The gun is worked by a crank handle on the right side, and the barrels and locks revolve together; but irrespective of this motion, the locks have a forward and backward motion of their own. The forward motion places the cartridges in the chambers of the barrels, and closes the breech at the time of each discharge, while the backward motion extracts the empty cartridge cases after firing.

"*Drum.*—The gun is fed by means of a metal drum, which fits on a pin in the centre of a hopper, communicating with the cartridge carrier. The drum has 16 channels or columns, each of which can receive 15 cartridges. Thus, each drum, when full, contains 240 cartridges. It weighs, empty, 22 lbs.; filled, 50 lbs.

"*Traversing Arrangement.*—The gun can be fired either in a fixed direction or with a certain lateral spread. The traversing motion is communicated to the barrels by means of a traversing worm fitted with a crutch. The crutch can be made to gear with the traversing worm or not, as required, and the amount of traversing to be given is regulated by four divisions on the worm corresponding to horizontal angles of 4° 45′, 3° 20′, 1° 50′, and 0° 20′ respectively.

"When no traversing motion is required, the gun is fixed in one position by lowering a locking-bolt into a recess in the rear of the trunnion plate.

"*Sighting.*—The gun is sighted on the right side, and is supplied with two sights—viz. one fore sight, of steel, and one hind sight, also of steel, graduated in degrees and yards."

The use of this nature of weapon is explained under the head of "Mitrailleur."

**Gauge**—A standard of measure. Gauges are in very general use in all mechanical departments. In the artillery service they are either in the form of rings or cylinders, which admits of the diameter of shot and shell being taken with expedition.

**Gauge, Crusher,** *vide* Crusher Gauge.

**Gauge, Iron Cylinder**—An instrument adapted for testing the body, studs, and pitch of rifling of muzzle-loading projectiles, at one operation. When the present number of this nature of gauge is used up, *iron ring gauges* will be introduced for general issue; the cylinder gauges being restricted to stations of inspection.

The following are the dimensions of the gauges for rifled field guns:—

| | Diameter over body. | Diameter over studs. | Diameter low over studs. |
|---|---|---|---|
| | Inches. | Inches. | Inches. |
| 16-pr. | 3·58 | 3·812 | 3·795 |
| 9-pr. | 2·98 | 3·212 | — |
| 7-pr. | 2·98 | 3·182 | 3·165 |

**Gauge, Pressure**—An instrument used in determining the pressure of the several natures of powder, at certain intervals within the bore of a gun. The result of experiments made with this instrument has been most successful, indicating, very exactly, the reduced force of both pellet and pebble powder as compared with ordinary powder.

The principal instruments of this kind are *Rodman's pressure gauge* and a pressure gauge invented for the special use of the Committee on Explosives, called a *crusher gauge* (*q.v.*). (*Vide* Proof of Gunpowder.)

**Gauge, Star**—An instrument used to ascertain whether the bore of a S.B. gun be of the proper dimensions throughout its length.

**Gauge, Steam**—A contrivance attached to steam engines, which indicates the pressure of steam in the boiler.

**Gauge, Trunnion**—An instrument used for measuring the diameter of the trunnions of a gun.

**Gauges, Cartridge**—Gun-metal rings of the required size, with a handle to each gauge, on which is stamped the nature and size of the cartridge. There are two kinds: one, for testing the diameter of the filled cartridge; the other, for showing the length of the cartridge.

**Gauges, Rocket**—Brass rings, which are used to ascertain whether the case is exteriorly of the proper dimensions.

**Gauges, Shot or Shell**—Instruments used for ascertaining the measurement of spherical projectiles. They are simply iron rings with metal handles, and of varying dimensions, for determining the diameter of the shot or shell. Only one high gauge for each calibre is issued. The projectiles should pass in all directions through the high gauge, but must not pass through the low gauge. Ring gauges will also be used for rifled projectiles as well. Low and high gauges are issued to firemasters and inspectors of warlike stores and store stations. (*Vide* Gauge, Iron Cylinder.)

**Gauntlet** (French, *gant*, a glove)—Armour for the hand and arm, made either of scales or mail, and used in the middle ages. It formed part of the armour of knights and men-at-arms.

The introduction of gauntlets took place about the thirteenth century. Throwing down the gauntlet in subsequent ages was a common mode of offering a challenge.

A leather gauntlet is now used, in place of gloves, by the household cavalry.

**Gear**—The name given to the clothing, head, and heel ropes, &c. of horses, and to the pads and trappings used with bullocks, camels, elephants, and mules, in draught or in carrying loads.

The term is also used when machinery is in motion, in the engagement or disengagement of its parts, such as lifting a wheel *out of* gear and throwing a wheel *into* gear. Machines are engaged or disengaged while in motion by various means, such as the *sliding pulley*, *fast and loose pulleys*, &c.

Gear also implies all apparatus for the lifting of heavy ordnance, and for the traversing and training of guns, &c.

**Gear, Bevel,** *vide* Bevel Gear.

**General**—A rank in the army next to that of field-marshal. As defined in Brande and Cox's 'Dictionary,' the name designates his command, as having the *general* or highest orders to give in battle. In the British army there are three grades of this rank—the highest, *general;* the second, *lieutenant-general;* the junior, *major-general.* The title of *brigadier-general* is given to an officer while in command of a brigade. When a large army is assembled, an officer is specially appointed to the command who may be, and generally would be, a field-marshal. Subordinate to him would be generals, commanding *corps d'armée;* lieutenant-generals, commanding wings of the *corps d'armée;* major-generals, divisions in the wings; and brigadier-generals, brigades in the divisions.

The duties of a general officer in command are of a very responsible nature, and require continued watchfulness and circumspection. In peace time the chief objects of his care and regard should be the condition of the several equipments in his command, respecting which he should call for specific information, and occasionally satisfy himself by personal inspection. These include the ordnance, carriages, &c., on the several defences; the arsenals and magazines; the state and quantity of the ammunition, with reference to the immediate wants for service, both for ordnance and small-arms; the condition of the horses and cattle within his command: in fact, as the whole responsibility devolves upon him, he must have his eyes and ears everywhere.

**Générale**—Formerly a beat of the drum for the assembly of all the troops preparatory to a march, battle, or action. When beaten unexpectedly, it was the signal for the whole of the troops to assemble at the alarm posts. (*Vide* Beat of Drum.)

**General Hospitals**—Hospitals specially formed on the outbreak of a war, for the reception of the sick and wounded who can no longer be kept in the field hospital. They are of such importance in a campaign that the best position should be chosen for them, both as regards safety and for sanitary reasons. General hospitals should be within easy distance of the army by rail or water. In selecting buildings for such purposes, ventilation and drainage are of primary importance. Huts and tents are frequently used as general hospitals, and are always preferable to private houses, as the latter are often too small for the purpose required of them, and do not always afford the regulation cubic space of air. The size of general hospitals should be limited to the reception of 500 or 600 men at a time, and when it can be managed, they should be cleared out as quickly as possible, and the invalids sent home to be distributed among the military hospitals. Considering the vastness of armies of the present day, the subject of hospital accommodation is a difficult question; the care of the sick and wounded must therefore, to some extent, be left to the many kind and liberal people who follow armies with the view of attending on the sick, and of distributing the many comforts they take with them, such as clothing, medical and other stores, that have been collected and forwarded, not only from the country of the sick and wounded, but from foreign nations. Such, it is happy to think, is the sympathetic and loving feeling evinced nowadays by the good and benevolent when war breaks out.

**Geneva, Convention of**—Promoted by Mr. Henry Dunant, and signed by all the continental powers in August 1864; Great Britain, Greece, and Norway joining in it in 1865.

By this convention it was decided that—

1. Ambulances and military hospitals are to be recognised as neutral, and as such to be protected and respected by the belligerents.

2. The *personnel* of these hospitals and ambulances, including the *intendance,* the sanitary officers, officers of the administration, as well as the military and civil chaplains, are to be benefited by that neutrality.

3. The inhabitants of the country rendering help to the sick and wounded are to be respected, and free from capture.

4. The sick and wounded are to be attended to without distinction of nation.

5. A flag and a uniform are to be adopted for the hospitals, ambulances, and convoys of invalids; an armlet (brassard) for the *personnel* of the ambulances and hospitals.

6. The flag and armlet to consist of a red cross on a white ground.

In order to carry out the engagements laid down in this convention, committees have been formed in all the large towns of Europe, and in the United States of America. The society is organised under the name of the *International Society for the Aid of the Sick and Wounded.* It was first called to play an important part during the Franco-German War (1870-1871), every nation sending its contingent of ambulances, surgeons, doctors, &c., and every purse contributing towards its support.

**Genouillère** (French, *genou*, a knee)—In fortification, is the part of the parapet reaching from the platform to the sill of the embrasure. It represents the ordinary height above the platform on which the gun is worked. In a barbette battery, the genouillère is the height of the crest of the parapet above the platform.

The term *genouillère* is met with in ancient armour, being flexible knee-pieces, with joints like those of a lobster.

**Gentlemen-at-arms**—A small body-guard of about forty men, in attendance upon the sovereign on state occasions. It formerly consisted of men of noble blood, but is now recruited from retired officers of the army. With the exception of the yeomen of the guard, it is the oldest corps in the British service. It was instituted in the beginning of the sixteenth century by Henry VIII.

**Geometrical Progression**—Quantities are said to be in geometrical progression when every succeeding term is a certain constant multiple or part of the preceding term. Thus $a$, $ar$, $ar^2$, $ar^3$, &c. is a geometrical series of which $r$ is the constant multiplier, called the "ratio." In such a sum the $n$th term $= l = ar^{n} - {}^{1}$;

and the sum $= a\dfrac{rn-1}{r-1} = \dfrac{rl-a}{r-1}$.

**German Army**—One of the chief continental armies of Europe.

By the Treaty of Prague, concluded between Austria and Prussia after the war of 1866, a new German confederation was formed. A few months later, Prussia concluded conventions with states forming the new confederation, by which they were bound to adopt any quarrel of Prussia arising out of the recent events, and to place their military strength at the absolute disposal of the Prussians. In order to ensure a unity of organisation, the military system of the latter was adopted by these states. And now, by the constitution of the German empire, bearing date the 16th of April 1871, the land forces of all the states form a united army under the command of the emperor. The German army thus includes the contingents of Prussia (with Hanover), Bavaria, Saxony, Würtemberg, Baden, and a number of other states.

The military system of the German empire is as follows, and it will be remarked how closely the French system resembles it. (*Vide* French Army.)

Every man is liable to military service, and must render such service personally, neither substitutes nor purchase of exemption being allowed. There are, however, certain social exemptions made, such as for sons of widows, supports of families, &c. The number of recruits annually raised is about 143,000 men, and the peace strength of the army is fixed at 401,659 men (one-year volunteers not included), or about 1 per cent. of the population. The age of conscription is 21; the period of military service is 12 years, divided into three portions of 3, 4, and 5 years; 3 years are passed by the conscript in a regular regiment, the next 4 years (on furlough) in the reserve, and the final period of 5 years in the *Landwehr* or second reserve of his district. This brings the soldier to about 32 years of age. After this, he is incorporated in the *Landsturm*, or service for home defence in case of war. Every young man can be called up 3 years in succession; those who are exempted in their third year are passed into the *Ersatz-Reserve*, and are free from military service, but can be called upon in time of war.

In order that civil professions may not be affected by military exigencies, youths of good character and education, and who have taken university or college degrees, can qualify themselves for one year's service. These *einjährigen Freiwilligen* (one-year volunteers) have to provide themselves with everything, viz. their accoutrements, equipment, and horse, if in the cavalry.

The regiments of the regular army during peace time are, on the breaking out of war, raised to double their number by recalling an equal number of men from the reserve, and each reserve man, so recalled, returns not merely to the same battalion, but even to the very company in which he had passed the first years of his military life.

The *Landwehr* battalion is the basis of the local organisation, both for recruiting and mobilisation. In peace time, these battalions exist only in cadres.

By this system Germany can easily place in the field an army of 1,350,000 men, not including the *Landsturm*, and has now (1875) a peace establishment of 428,000 voted for 7 years, including officers and volunteers, with a budget of £16,000,000.

The German army is organised on the territorial system, and divided into 18 army corps, of which 13 are furnished by Prussia, including the contingents furnished by Hanover, Schleswig-Holstein, and the minor states annexed to Prussia in 1866; 2 by Bavaria, 1 by Saxony, 1 by Würtemberg, and 1 by Baden and the contingent of Alsace-Lorraine. Each *corps d'armée* has a district, which is formed by the province within which it is raised, recruited, and stationed. These corps districts are subdivided into divisions and brigades, and these again into *Landwehr* battalion districts. Districts are further subdivided into company districts, of which there are from 3 to 6 to each battalion. The *corps d'armée* of the guard and the one furnished by Saxony consist of 2 infantry divisions and 1 of cavalry. The others have two divisions, except the 11th, which has 3. Each division has 2 infantry brigades and 1 of cavalry. The Saxon and the 12th corps have 2 brigades of infantry; the cavalry of the guard has 3, the Saxon and the 15th corps 2 brigades of cavalry each.

Independently of these divisions, each corps possesses 1 or 2 *battalions of rifles* (the guards 1 of rifle and 1 of sharpshooters, and the Bavarian army 10 battalions of rifles), 1 regiment of field artillery, 1 regiment or battalion of foot artillery, 1 battalion of pioneers, and 1 of military train, as well as 1 battalion *Etappen* troops, 1 of instruction, 1 of *gendarmerie*, belonging to the staff or permanent army.

There are 74 brigades of infantry; each brigade is composed of 2 regiments of the line, and 2 of the *Landwehr*, giving a total of 148 regiments of the line.

A regiment on war footing has 60 officers, 3000 men, 73 non-combatants, with 105 horses and 19 wagons.

The regiments of infantry consist of 3 battalions, the third one being fusiliers. Each battalion has 4 companies, and has a peace strength of 552 of all ranks, and a war strength of 1022.

Besides these field battalions, a fourth or depot battalion, 1240 strong, is formed on mobilisation.

The rifles and sharpshooters (*Jäger* and *Schützen*) are not organised in regiments, but form independent battalions. They are recruited from picked men, chosen throughout the army corps district.

The cavalry of the German army is divided into 38 brigades; 1 brigade is composed of 4 regiments, 15 of 3, and the 22 others of 2 regiments, giving a total of 93 regiments—12 of cuirassiers (including those of the guard), 34 of dragoons, 18 of hussars, 25 of lancers, and 4 Saxon regiments.

In peace time these regiments consist of 5 squadrons, of 4 officers and 135 men each; in war time they take the field with 4 squadrons of 150 each, while a fifth remains behind to form the depot.

The brigades of field artillery are generally composed each of 2 regiments, of which 1 is composed of 2 sections of 4 batteries, forming the division artillery; and the other, consisting of 2 sections of 3 batteries, and 1 section of horse artillery of 3 batteries, forming the artillery of the *corps d'armée*. Each battery has 4 guns.

The foot artillery brigade is, with few exceptions, composed of 2 battalions of 4 companies each; to these must be added 1 company of instructors for the school of gunnery, and 1 company for laboratory purposes.

The battalions of pioneers have each 4 companies—1 of pontoons, 2 of sappers, and 1 of miners. The *Etappen* battalion, which is under the direct command of the chief of the staff, has also 4 companies. The peace establishment of each company is 146 men, but on the war footing it is increased to 218 men. Further, there is 1 railway battalion, and 13 sections of field telegraph. (*Vide* Railway.) The train is a mere skeleton on a peace footing, and has 37 companies with a strength of 5049, which amounts to nearly 49,000 men when it takes the field.

The German artillery is armed with B.L.R. guns of cast steel (Krupp's system); the field batteries have 8·8-c. guns, and throw shrapnel weighing 17·9 lbs.; the horse artillery have 7·85-c. guns, throwing the same nature of shell, weighing 12·2 lbs.

On war being declared, the different *corps d'armée* are formed into armies; and to obtain the necessary strength to place them on a war footing, the government calls under the colours the yearly contingent of conscripts, the reserves, and the men of the *Landwehr*. The whole army is then divided into (1) field, (2) depot, and (3) garrison troops.

The field troops of a *corps d'armée* comprise:—

(*a*) Two divisions of infantry, each having 1 regiment of cavalry and 1 detachment of artillery (24 guns).

(*b*) The artillery of the *corps d'armée*, of 1 regiment of field artillery, of 6 field batteries and 2 horse artillery batteries.

(*c*) Three independent companies of pioneers.

(*d*) *Sections of columns*, viz.: 10 columns of ammunition, 3 of pontoons and train, 5 of provisions, 3 sanitary detachments, 1 remount depot, 1 column of field batteries, 5 columns of land transport, 12 ambulances, the *intendance* (commissariat), field post, &c.

The other cavalry regiments, not attached to the different divisions, are formed into cavalry divisions of 2 and 3 brigades and 3 batteries of horse artillery. These divisions are under the immediate command of the general-in-chief.

The army is commanded by the emperor, with a war minister, and a chief of the staff under him. The war department is divided into three principal offices as follows:—

1. Central office, including the ministerial one.
2. General war department, comprising organisation, mobilisation, quartering, training; strategical and purely military questions.
3. Military finance department: pay, clothing, equipment, and supply.

The great general staff of the German army is thus divided:—

1. Central bureau: general correspondence and direction of all the other sections.
2. Three sections; collect all available and latest information concerning European armies, &c., each section having a certain number of countries under its charge.
3. Railway section (*vide* Railways).
4. Military history section: historical records, histories of great wars, annals, &c.
5. Geographical statistical section, connected with the topographical section: topography and statistics of foreign nations; statistics of Germany.
6. Topographical and land triangulation: survey (land and cadastral), with special regard to military requirements.
7. Intelligence office (*vide* Intelligence Department).
8. Map room: store room for original surveys, maps for distribution.

There are 61 officers on the general staff at Berlin, and they are divided into two classes:—

1. Active staff, liable to serve with corps and divisions in their turn, and
2. The *Neben-Etat*, or accessory establishment, consisting of from 30 to 40 officers noted for special acquirements, but who do not belong to the first division.

There are besides 113 employés, such as registrars, draughtsmen, &c.

Bavaria and other German states have similar establishments, under the supervision of the great general staff at Berlin.

The mode of officering the German army is in two ways:—

1. By candidates passing the required examination in general subjects, serving a short time in the ranks or otherwise as non-commissioned officers, and qualifying in the theoretical knowledge of their profession after a nine months' course of study at the *Kriegsschule*, or school of war.

2. By passing the latter examination direct from a special superior class of the corps of cadets.

There is no examination for promotion to any commissioned rank in the army, promotion being obtained by relative merit. Men of ability are noticed by those in authority and promoted; those of inferior capacity are kept in the background. (*Vide* Appendix C.)

**German Gun,** *vide* Krupp Gun.

**Ghurrie**—An Indian term; a circular plate of gun-metal, issued to troops in India, in the proportion of one per regiment, for the purpose of striking the hours. This kind of plate is made up in the country.

**Gimbal**—A mechanical contrivance for keeping a suspended body vertical, whatever be the derangements to which the points of suspension are liable. It consists of two brass rings which move within one another, each perpendicularly to its plane about two axes, placed at right angles to each other.

**Gimlet**—A fluted tool, which terminates in a sharp worm or screw, beginning as a point, and extending to the full diameter of the tool, which is drawn by the screw into the wood. The principal part of the cutting is done by the angular corner intermediate between the worm and shell, which acts much like the auger. The gimlet is worked until the shell is full of wood, when it is unwound and withdrawn to empty it.

**Girder**—The longitudinal beam in a floor. Girders are the chief supports of a ground floor; their depth is often limited by the size of the timber, but not always so. Girders of wrought and cast iron are now extensively used in the construction of bridges, *to girt railroads*, canals, &c., and many of them are of considerable span.

**Girth**—A band or strap made of web passing round the belly of a horse or other animal, to keep the saddle in its place. There is a girth known as the *Australian girth*, which is made of a network of hide or cord. It is very much approved of in the German army, and has been adopted by the cavalry of that nation. It never gets saturated with sweat, and is therefore less likely to get stiff and hard, and hence causes fewer girth galls.

The term *girth* is also used with reference to the circumference of timber, &c.

**Gisarme**—A very ancient weapon, formed, it is stated, with a lance and a hook on one side of it, both to unhorse the rider and wound him also, and to leave him exposed to attack by sword.

**Glacis**—In a fortification, the parapet of the covered way extended in a long slope to meet the natural surface of the ground, so that every part of it shall be swept by the fire of the ramparts.

**Glanders**—A disease to which horses are subject. Mayhew, 'On the Horse,' states that it is "brought on by stimulating food, combined with exhausting labour; damp and want of ventilation will also produce it. The disease termed farcy is glanders, only modified by the cause that originates it. Glanders is the more vigorous form of the disorder, farcy is the slow type fastening upon general debility. The disease is highly contagious; and though a stable may be perfectly clean, yet this poison may have been lodged there by the last inhabitants; it is not only contagious to horses but equally dangerous to men. Running from the nose indicates very often the setting in of the disease, but the following signs appear when glanders exist: a staring coat, bad appetite, and the pulse is quickened, and soon afterwards a slight discharge from one nostril; this is followed by one of the sympathetic glands, on the same side as the moist nostril, altering its character. The next change that takes place is the disappearance of the transparent fluid from the nose, which is succeeded by a full stream of unwholesome pus. When the third stage is witnessed, the disease is rapidly hurrying to its termination. The membrane of the nose changes to a dull leaden colour; the margin of the nostrils becomes dropsical, and every breath is drawn with difficulty. The defluxion exhibits discoloration; scabs, masses of bone, or pieces of membrane, mingled with patches of blood, next make their appearance; and the internal parts are evidently being broken up by the virulence of the disorder. It is an incurable disease, and the horse should be shot at once."

When farcy, glanders, or other infectious diseases have shown themselves amongst artillery or cavalry horses, the animals so attacked should be removed from the rest of the horses, and those free of disease be frequently and carefully examined, under the orders of the commanding officer, with the view of detecting the slightest approach of the prevailing sickness.

**Glazing**—A process to which gunpowder is subjected; it adds somewhat to its durability and to its density, and by reducing the grains to nearly the same size gives uniformity of range, combustion being more equalised; powder also, by being glazed, stores and travels better. The process of glazing follows that of dusting. The barrels used in the operation contain about 400 lbs. of powder, and make from 32 to 38 revolutions in the minute. The time expended in glazing depends upon the nature of the powder. A little graphite is sometimes placed in each barrel to assist in giving a polish to the grain. It was found in the Indian factory at Ishapore that the mere friction of the grains against each other did not impart a high glaze without the aid of graphite.

**Globe of Compression,** *vide* Compression, Globe of.

**Glue**—An impure desiccated gelatine, procured from various sources, such as the scraps of ox and other thick hides, the débris of tanyards, the tendons and intestines of many animals, rabbit skins deprived of their fur, scraps of parchment, old gloves, and many other apparently worse than useless matters, all contributing their quota in the manufacture of "glue." Glue is an invaluable substance in fixing together all kinds of woodwork.

There are several kinds of glue, such as *liquid glue*, *marine glue*, and *mouth glue*.

*Liquid glue* is a useful cement; it withstands damp much better than the common glue. It is prepared as follows: Dissolve one ounce of borax in a pint of boiling water with two ounces of shellac, and boil in a covered vessel until the lac is dissolved.

*Marine glue*, that known as Jeffery's patented marine glue, is a compound of india-rubber, shellac, and coal-tar or naphtha. It is remarkable for its great strength. The colour of this glue, however, unfortunately prevents its being much used. The interior of diaphragm shells is coated with it, so as to fill up any interstices which there may be between the diaphragm and the socket. This glue also prevents the shell deteriorating from rust.

*Mouth glue* is used for uniting papers and for gluing down paper to plan or drawing boards. It is made by dissolving pure glue with the aid of heat, such as parchment glue or gelatine, with about one quarter or one-third of its weight of coarse brown sugar, in as small a quantity of boiling water as possible. This, when perfectly liquid, should be cast into thin cakes on a flat surface very slightly oiled, and, as it cools, cut up into pieces of a convenient size.

**Glyacyline**—An explosive substance composed of gun-cotton and nitroglycerine, invented by Mr. F. Abel, F.R.S.

**Gnomon**—The hand of a sun-dial. Lardner gives the following explanation of its use:—"It is placed at such an inclination with the plate of the dial that, when properly set, the gnomon will be directed to the north pole of the heavens, and its shadow will fall upon the same lines of the dial at the same hours, whatever be the season of the year, that is, for one particular latitude, but dials must be differently constructed for places which have different latitudes. It is shown in astronomy that the elevation of the celestial pole is equal to the latitude of the place, and, consequently, the inclination of the gnomon of a sun-dial must be also equal to the latitude of the place where the dial is intended to be set. It follows, therefore, that a dial constructed for London would not be suitable for Edinburgh."

**Goloshes, Leather**—Are large, loose, untanned leather boots, the high sides of which extend a considerable distance up the calf of the leg. They are intended to be worn in magazines, powder-houses, and buildings containing combustible stores, and are made of different sizes suitable to cover the ordinary shoe or boot, and must be put on before entering any of the above buildings.

**Golundause** (Persian, *gol*, a ball, and *andakhtun*, to throw)—An Indian term for an artilleryman.

**Gomer Chamber**—A conical chamber which is joined to the cylinder of the bore by a portion of a spherical surface. It is so called from the French officer who invented it, and has been applied, since the year 1820, to all S.B. guns, howitzers, and mortars.

**Gonfanon,** or **Gonfalon**—One of the arms used by the Normans in the eleventh century. It was a spear, sometimes ornamented with a small flag, fixed just below the metal point, and similar to our present lance.

**Good-conduct Badges**—Marks of distinction for good conduct, which are bestowed upon soldiers. Each badge carries with it a reward of a penny a day. The badges are worn by soldiers below the elbow, with the points up.

**Good-conduct Pay**—A reward of additional pay to corporals and private soldiers for good conduct. It is granted under the following circumstances. A soldier whose name does not appear in the regimental defaulter book for at least two years preceding his claim receives—

After 2 years, 1d. per diem, with one good-conduct badge;
After 6 years, 2d. per diem, with an additional badge for each penny;
After 12 years .. .. 3d. per diem;
„ 18 „ .. .. 4d. „
„ 23 „ .. .. 5d. „
„ 28 „ .. .. 6d. „

A soldier of 16 and less than 18 years' service, and whose name has not been entered in the regimental defaulter book for 14 years, next preceding the date at which he shall *become entitled* thereto, shall receive the rate granted by article 911 of the warrant, after 18 years' service, on completion of such 14 years' continuous good conduct; and shall receive the rate attached to 23 and 28 years after 21 and 26 years respectively.

The warrant further states that a soldier shall not be advanced to a higher rate of good-conduct pay unless he shall have been in the uninterrupted receipt of the next lower rate for the 2 years immediately preceding his claim. But this condition shall not apply to the accelerated rates specified in article 914.

Non-commissioned officers do not receive good-conduct pay, but receive instead 2d. a day as an increase to their regular pay. They receive, as well, rewards for distinguished or meritorious services, annuities and medals, either while serving or after discharge.

A warrant, dated May 29, 1875, has been issued by the Secretary of War, revising the regulations contained in the warrant of December 27, 1870, relative to the forfeiture of the service of soldiers, and to amend in certain respects the regulations relative to good-conduct pay. (Vide Appendix J.)

**Good-service Pension**—An annuity of £100 a year, given to general or field officers as a reward for distinguished or good service. Only a certain number of annuities is granted. This reward is held either for life or until an officer succeeds to his colonel's allowance.

**Gorge**—The gorge of a work is a line joining its inner extremities. An entrance in the rear of a fortified work, such as a bastion, redan, &c., is also called a gorge.

**Gorget** (Italian, *gorgiera*, a throat)—A certain piece of ancient armour worn for the protection of the neck. It ceased to be worn, like other articles of body armour, during the reign of Queen Anne.

**Governor** — One who governs. An official invested by the sovereign with the chief power of a province, in which he is placed to represent the British government. In questions beyond his authority he has to refer to the Secretary of State for the Colonies. The governors of the minor presidencies of India refer such questions which they have not the power themselves to settle to the governor-general of that country, or to the Secretary of State for India. In some of the colonies the governor is commander-in-chief as well.

**Governor of an Engine**—As described in Baker's 'Elements of Mechanism,' "is one of the most important regulators of a steam-engine; it consists of a series of jointed rods, which play upon a vertical spindle, having at the extreme points of the rods two balls. It is connected with the throttle valve of the steam-engine by a lever, and the proportion and position of the rods are so adjusted that when the balls descend to their lowest position, the throttle valve opens, and when they separate, it becomes gradually closed. A grooved wheel, or oftener a toothed pinion, is fixed upon the axle of the spindle, which receives its motion from any convenient part of the machinery. Suppose then the load of the engine to be suddenly diminished, or the force of the steam increased, then a momentary augmentation of speed will take place in the piston, and, consequently, an increased velocity will be imparted to the wheel and balls of the governor; these balls will, therefore, fly further from the spindle, the fork will be drawn down, the throttle valve partially closed, and the supply of steam to the cylinder diminished. If, on the contrary, the load of the engine be increased, or the force of the steam diminished, the speed of the piston will be momentarily slackened, the velocity of the wheel diminished, the balls will descend and approach the spindle, the fork will be raised, and the valve be partially opened. In this manner the governor has the effect of admitting at all times to the cylinder just that portion of steam that is necessary to give the piston its proper speed, the quantity being always proportioned to the load of the engine."

**Governor-General of India**—The chief executive officer of that dependency, having also the rank and position of a viceroy. He is appointed by the crown for a period of five years, which, however, can be extended. The governor-general is subject in all matters of moment to the control of the crown, through the Secretary of State for India. He is assisted by an executive council, composed of six members, should he see the necessity of so many, viz. two civilians, a law and financial member, a military member, and a member of public works. All acts of the government are performed in the name of the governor-general "in council;" not that he is necessarily bound to the majority of his council, as he can dissent altogether from their opinion, and act accordingly, if he thinks fit.

The above members, with the addition of a civilian from Madras and Bombay, a few non-official members selected from the European commercial community, and one or two native noblemen, constitute the supreme legislative council for making laws and regulations. But the governor-general has the power of making rules and regulations, on an emergency, with reduced numbers of his council.

**Grade**—A degree of rank, in order or dignity, civil, military, or ecclesiastical.

**Gradient**—A term indicative of the proportionate ascent or descent of the several planes upon a railway; thus, an inclined plane, 4 miles long, with a total fall of 36 feet, is described as having a gradient of 1 in 587, or 9 feet per mile.

**Graduate, To**—To mark anything in degrees of equal parts, as distinguished from the division into inches, or other certain and determinate measurements. Hence, in graduating an instrument, the length of the degree is in proportion to the size of the instrument; but a measurement in inches, &c. has no reference to the length of the scale employed.

**Gram** (*Cicer arietinum*)—A name given in Oriental commerce to the produce of two leguminous plants cultivated in India, and chiefly used for feeding horses, bullocks, &c.

**Granulating**—An operation in the manufacture of gunpowder which follows the process of "pressing" the cake, whereby it becomes reduced to grains of different sizes, according to the sieves used. The reduction of the press cake into the form of grains is effected by means of toothed rollers (three pairs of different degrees of fineness being used), the cake passing between each pair of rollers, under which is a screen covered with a certain-sized mesh wire; in addition to these screens, as in the Waltham Abbey granulating machine, there are three oblong sieves covered with different-sized wire, and Cyprus cloth, respectively, fixed under and parallel to each other, running at an incline just below the three pairs of rollers. This arrangement permits of the powder being dusted, as well as granulated, by the same machine.

**Grape Shot**—A species of projectile which, under the name of *quilted grape*, was in general use before the introduction of case shot (*q. v.*). The pattern now in the service is known as *Caffin's pattern*, which consists of sand shot, arranged in three tiers, by means of three cast-iron circular plates, and a bottom plate of wrought iron; the whole is secured firmly together by means of a wrought-iron pin, which passes through the centre of the plates. The number of shot in each tier varies from three to five, according to the nature of gun for which the grape shot is intended. The advantage of grape over quilted shot is that it stows better, is more easily put together, and more durable, and the effect is considered to be greater. In the attack and defence of works it would still be used from smooth-bore guns, and is effective up to 600 yards.

**Graphite**—Commonly called black-lead, is described in Abel and Bloxom's 'Handbook of Chemistry' as another crystalline modification of carbon, very different in appearance and physical properties to the diamond. It is found in Cumberland, Siberia, Ceylon, in Germany and France, and in North and South America. Graphite is a very good conductor of electricity; like the diamond it is unalterable by heat. It may be prepared artificially by bringing an excess of charcoal in contact with fused cast iron; a portion of the carbon dissolves, and separates out again on cooling in large scales. It is used sometimes, amongst other purposes, in glazing gunpowder.

**Grapnel**—A small anchor of several flukes, used in mooring boats or pontoons for military bridges. A grapnel having five prongs is also used for escalading purposes, to aid the assailants in effecting an entry into the place. When it is thus used, it is thrown over *any spot where it* is likely to anchor itself. A 2-inch rope, 60 feet in length, is attached to the shank.

**Grass-cutters**—Natives of India attached to the artillery and cavalry branches of the service in that country, whose sole duty is to collect and bring in grass daily for the horses of their regiment. There is one to each horse or one to every two horses; the latter is called a *jorawallah*, and receives the pay of two men, but under these circumstances he has to keep a pony, and bring in grass equal to the load of two men. A grass-cutter's pay is from 8s. to 10s. a month.

**Gratuities**—In the army, are sums of money given to soldiers under the following circumstances:—To soldiers on re-engagement, that is, when they engage to serve on for a longer term of service; to soldiers settling, on discharge, in the colonies; and to all good-conduct soldiers on discharge. This latter gratuity is taken from a fund formed of the fines imposed upon drunken soldiers. (*Vide* Appendix J.)

**Gravimeter**—An instrument for ascertaining the specific gravity of bodies, solid or liquid.

**Gravity**—A term used to denote that force by which every material particle is urged towards the surface of the earth as soon as it is left unsupported. The intensity of the force of gravity is constant at the same place, and is a uniform force which accelerates all bodies equally.

**Gravity, Centre of**—Is explained to be "that point in bodies through which the resultants of the gravity of their particles pass. A line drawn in the vertical direction through the centre of gravity of a body is called the line of direction of the centre of gravity." In a spherical shot of equal density throughout, the centre of gravity will be in its centre of figure, but as it is almost impossible to cast solid shot of perfect sphericity and density, its centre of gravity will be found either above, below, to the right or left of its centre of figure. In hollow spheres, such as shells, the centre of gravity is an imaginary point within the cavity of the shell. In irregular figures, the centre of gravity sometimes falls without the dimensions of the body.

**Gravity, Specific**—As defined, "is the relative gravity of any body or substance, considered with regard to some other body which is assumed as a standard of comparison, which standard, by universal consent, is rain-water: this kind not being subject to much variation from time, place, or other circumstances. One cubic foot of rain-water weighs exactly 1000 (avoirdupois) English ounces; hence the relative weights of other bodies is easily referred to this standard. The following table, showing the specific gravity of the under-mentioned solids and liquids, will be found useful:—

| | |
|---|---|
| "Water | 1 |
| Platinum | 21·5 |
| Gold | 19·5 |
| Mercury | 13·5 |
| Lead | 11·45 |
| Silver | 10·5 |
| Copper | 8·96 |
| Steel | 7·8 |
| Iron, rod | 7·7 |
| Iron, cast | 7·2 |
| Diamond | 3·5 |
| Rock crystal | 2·6 |
| Window glass | 2·52 |
| Sulphuric acid | 1·84 |
| Wax | 0·964 |
| Oil of turpentine | 0·865 |
| Spirit of wine (strong) | 0·83 |
| Ether | 0·72 |

"GASES.

| | |
|---|---|
| "Atmospheric air | 1 |
| Carbonic acid | 1·524 |
| Oxygen | 1·106 |
| Nitrogen | 0·972 |
| Carbonic oxide | 0·967 |
| Hydrogen | 0·069" |

**Grazing Fire**—When the trajectory is low and nearly parallel to the ground, and when the projectile strikes the object, whether vertical or horizontal, at a less angle than 10°, this is termed *grazing fire*.

**Grease**—A lubricator used for the axle arms and wheels of gun and other carriages. It was formerly composed of equal parts of tallow (mutton fat) and coarse sweet oil. This composition has since been changed for a mineral grease, "Fenner's," consisting of the heavier products obtained in the preparation of paraffine or petroleum oils. The lubricant applied to railway wheels is formed of soap with a small portion of soda, which effects an imperfect saponification and thus prevents a too rapid expenditure of the mixture, which would otherwise be the case, owing to the heat caused by the rapid revolution of the wheels. Cocoa-nut oil and palm oil are also used as lubricants.

In the veterinary art, the term grease is applied to a complaint which horses are subject to, the treatment of which is as follows:—"Cut the hair close, apply finely powdered dried charcoal, and poultice over it, give physic and diuretics; when pain and discharge cease, apply dry bandages; astringent applications are sometimes useful; exercise is desirable when the legs are much swollen; procure green food, if possible."

**Greek Fire**—A combustible composition used in ancient wars, which has the power of burning under water. It is said the Greeks were the first to use it. Its power appears to have been greatly exaggerated. It is supposed that the following ingredients entered into its composition: the gum of the pine and other resins pulverised, with sulphur, naphtha, camphor, petroleum, and other bituminous substances. The Americans used it in the bombardment of Charleston as prepared by Mr. Levi Short. His so-called Greek fire consisted of two kinds, one of which was a dry composition, the other liquid. The former was composed of saltpetre, sulphur, and lamp-black, driven into a little iron tube, about 3 inches in length, and ½ inch in diameter, and open at one end. The composition was pierced a short distance up its centre with a fine hole, and burnt therefore with considerable violence from the open end. The outside of the tube was covered with pitch with the object of creating a flame. A number of these tubes were placed inside a shell with the bursting charge, which was ignited by a fuze in the ordinary way. The explosion of the bursting charge opened the shell, and ignited the little tubes of "Greek fire," which were thus scattered about among the enemy.

The liquid kind of Greek fire was composed chiefly of naphtha, and poured into the shell previous to being discharged.

**Green Charge**—In the manufacture of gunpowder, certain processes have to be carried out, the primary one being that of "mixing the ingredients" after they have been weighed and brought into contact previous to being incorporated. The process of *mixing* is performed by putting the composition into a cylindrical gun-metal or copper drum, about 2 feet in diameter, with an axle passing through its centre, on which there are metal flyers like forks; the machinery is so arranged that the flyers and drum revolve in opposite directions, at a rate of about 100 revolutions a minute; five minutes is long enough for a thorough mixture; the charge is then drawn off by a slip into a canvas bag capable of holding a 50-lb. charge, which is tightly tied and removed to a small magazine until required for the incorporating process. In this form it is called a *green charge*.

**Greenwich, Royal Naval College**—This college was founded in 1873 for the purpose of giving naval and marine officers greater opportunities, than those held out by the naval college at Portsmouth, for the study of all subjects, theoretical and scientific, bearing upon their profession. The general organisation of the college is as follows: a flag-officer as president, assisted by a post-captain in matters affecting discipline, &c., a director of studies, and a staff of professors on various subjects. The college is open to naval officers from the rank of sub-lieutenant to that of post-captain, and also to officers of the marine artillery and marine light infantry. Two officers of the royal marine artillery and six of the royal marine light infantry, below the regimental rank of lieutenant-colonel, who have been embarked for not less than two years, may be admitted annually as students. They are examined on entry, and may remain two terms, should they satisfy the examiners at the end of the first term. The marine officers, after passing into the service, are kept at this college. They receive full pay and 1s. 6d. a day towards mess expenses. Royal marine artillery officers remain two years (i.e. 18 working months); light infantry officers 9 months, and are required to pass an examination on leaving for headquarters.

**Greeves**—Plate armour for the legs, worn by the knights of old.

**Grenades**—As explained in Captain Majendie's 'Treatise on Ammunition,' are small shells thrown by hand, and hence termed *hand grenades*. They are filled with powder, and have a fuze fixed in them; they are of two sizes, the land service or 3-pr. and the sea service or 6-pr. hand grenade. The former are used in the defence of places against assault, being thrown amongst the storming parties in the ditch, and the latter against masses of men attempting to board, or under any other such circumstances in which they can be made available. They are also fired in volleys from mortars. The use of grenades seems to have become known in 1594; at least they were then invented, and were first projected from hand mortars. They gave the name in France to the troops called *grenadiers*, who were soldiers trained in the art of throwing hand grenades in the attack of trenches, or in the covered way.

**Grenadier**—This name was originally given to soldiers who threw grenades; but as shown in Brande and Cox's 'Dictionary,' it was afterwards conferred on certain troops of the line, distinguished by peculiarities of dress, accoutrements, &c. The name originated with the French, and subsequently was adopted in all the armies of Europe. Each man of the grenadier company carried grenades—hence the name—besides his matchlock. It was in 1678 that each grenadier company in a British regiment was armed with grenades, but in Queen Anne's reign this ceased to be the case. Generally the tallest and finest men were selected for the grenadier company, who took the right of the line. It is not many years ago since there was a grenadier company in each regiment in the English army, but there is no such company now, and the name of grenadiers only exists with the Grenadier Guards.

**Grenadier Guards**—The first regiment of the household infantry, and the senior regiment of infantry in the army. In 1656, under the auspices of Charles II. when an exile from England, and residing in Spanish Flanders, a little band of Royalists, as they were termed, composed for the most part of Englishmen, collected round Charles' standard, and formed the first nucleus of this distinguished regiment, the colours of which bear the record of many a European battle-field.

**Gripes**—A complaint with which horses are often attacked; the remedy recommended is as follows:—"On the horse being observed to be in pain, he should be trotted about until his bowels are emptied. Should this fail, he must be bled to the extent of two or three quarts, and a ball composed of one drachm of gum opium and two of powdered ginger, made up with bruised meal, given to him, and a clyster of oatmeal gruel every two hours."

**Groove**—A furrow or narrow channel cut in a spiral direction on the interior of a gun barrel, such as is observed in rifled ordnance and small-arms. (*Vide* Rifling.)

**Ground**—A common term in military phraseology, meaning the field or place of action. What is termed *taking ground* is the extension of a body of troops in any direction. To *gain ground* is to advance, to *lose ground* is to retire or retreat.

**Grummets**—Circular pieces of rope attached to shot to keep the shot steady in the bore. They are made of various sizes. Grummet wads are also used when firing at angles of depression, or at angles of elevation less than 3°; the grummet is placed over the shot to prevent it from running out of the piece. The use of grummet wads with rifled muzzle-loading guns has been discontinued for land service, except when these guns are firing at a depression. The term *grummet* is applied to a rope ring worked in a particular manner.

**Guard** — A body of men occupied in preserving a person or place from attack or injury. In a garrison or cantonment, guards are daily told off to protect any particular post or spot, or government property; to quell petty disturbances, and to take charge of men placed in confinement for any fault or crime they may have committed at or near the guard. There are a variety of duties attached to a guard, which are fully detailed in the Queen's Regulations. There are further many natures of guards, placed and named with reference to the duty they are employed on. A guard remains on duty 24 hours before being relieved. The term *mounting guard* is given to a guard going on duty.

**Guard of Honour**—A guard drawn up to receive royal personages and persons of distinction, and to attend at state ceremonials. It consists, as a general rule, of 100 rank and file, with a captain in command, two subaltern officers (one carrying the first colour), and a proportion of sergeants. The regimental band attends when the Queen or other exalted personage is to be received.

**Guard Report**—A report sent in by the relieved officer to the officer commanding, detailing a statement of duties performed by his guard while on duty. Commanding officers of guards are to mention the particular hours at which they went their rounds, as well as the hours at which their guards were visited by officers on duty, and by "rounds" of any description. Whilst on guard, they are to send an immediate report to the field officer, or captain of the day, of any unusual occurrence taking place.

**Guard Room**—The room occupied by the guard during its tour of duty. There is a room in the guard-house in which prisoners, awaiting the investigation of their crimes, are kept. Under the same roof a room is attached in which the officer commanding the guard resides during his tour of duty.

**Guards**—Comprehend a body of troops raised for the protection of the sovereign; they are called "household troops." Sovereigns of all countries have had body-guards attached to them from the earliest times. In the British service, the horse and life guards, with the foot guards, form the household troops. Though these troops are virtually the protecting guards of the sovereign, they are nevertheless available for active service whenever required. (*Vide* British Army.)

**Guddeelah**—Indian name for a padded cloth placed on the back of a draught elephant before the harness is put on. It is made of kurwah cloth stuffed with cotton, the edges being bound with leather.

**Gudgee**—An Indian cloth used in the lining of sepoys' tents.

**Gudgeon**—Is thus described:—"The circular part of a shaft or axle upon which a wheel revolves. The gudgeons on cast-iron axles are simply parts of the extremities of the axles turned exactly circular in a lathe. The circular apertures in which the gudgeons turn are called *brasses;* they are made of a composition of copper and tin, and are very durable, as well as not readily worn by the friction of the iron axles. The beams in which the brasses are fixed are called "bearings" (*q. v.*).

**Guerillas**—Small bands of men raised by the Spaniards in the Peninsular campaign, who fought in detached bodies against the French, harassing them in the mountainous defiles of that country. This desultory sort of warfare was most damaging to the enemy. The warfare carried on by the French *franc-tireurs* during the late continental war may be likened to that carried on by guerillas, with this exception, that the former were formed into companies, each company fighting and manœuvring on its own account, whereas the latter fought independently in small bands. It was only during the latter part of the war that it was found necessary to attach the *franc-tireurs* to brigades, and to place them under military control.

**Guides**—Men raised in an enemy's country, by high pay or any other inducement, to give such aid or information to the invading force as will enable it to compass the ends in view, viz. to obtain reliable information as to the enemy's position, to enable the leading columns to march on the points required in safety. With this view a body of intelligent men is collected at head-quarters, to enable one or more to be sent with every detachment of troops which leaves the camp. The duties devolving upon a guide are such that any want of reliability or truthfulness would involve the sacrifice of his life.

In the Indian army the name of "Guides" is given to a regiment of cavalry and infantry attached to the Punjab frontier force. It was raised by the late Sir Henry Lawrence, chiefly with the view to the men acting as scouts, and obtaining every available information about the country they happened to be in; also to act in expeditions as *avant-courriers* of the force to which they belonged, and (the cavalry branch) in carrying orders that required despatch.

**Guidons**—The standards of dragoon regiments, on which the devices, distinctions, and mottoes of the regiment are embroidered.

**Gun**—Any kind of fire-arm, or weapon, from which balls, shot, or other deadly projectiles, are forcibly discharged by the explosion of gunpowder. The term gun has been often indiscriminately applied to fire-arms of all natures; the name, however, is now confined to that species of ordnance called cannon, especially adapted for throwing solid shot and shell.

The general shape of a gun is that of the frustrum of a cone, the bore being a cylinder; the thickest portion of the metal is at the breech, from which it tapers to the muzzle; and this form is necessary, as at the breech the gun has to stand the first shock of the elastic force of the gunpowder, which diminishes in power as it extends towards the muzzle.

In the manufacture of our rifled guns, which are built up of a succession of wrought-iron coils, the same principle is observed as in smooth-bore guns, described above. The barrel on which the coils are shrunk is a tube made of steel, except in the early Armstrong guns and those converted on Major Palliser's system, which have a wrought-iron instead of a steel tube. The thickness of metal in a gun varies with the nature and weight of projectile and charge, and whether the gun be rifled or smooth-bored; in the former case, from the friction the shot has to overcome in the passage up the bore, the gun has to be made stronger than one of the latter class. The length of the bore should be such as to allow the whole of the charge to be consumed. The length of rifled guns in the British service varies from twelve to twenty calibres. As regards preponderance, there is very little given to them, it being found that a gun can be more easily worked without it.

Guns began to be used in Europe early in the fourteenth century, and, as shown in the article under the head of Artillery, were very rough specimens of the art. Within the last century the manufacture of ordnance has immensely improved, and though cast-iron guns have now been superseded, they did their work well as our heavy artillery. The manufacture of B.L.R. and M.L.R. guns is of recent date, the former having preceded the latter under the able superintendence of Sir W. Armstrong, the inventor of the coil system. To him is due in a great measure the improved condition of our artillery, and notwithstanding his breech-loading system has been discarded, we owe to him the use to which he has put wrought iron in the manufacture of guns. His light guns have done good service in India and China, and a few Armstrong batteries are still in use in the former country; they will soon, however, be superseded by the M.L.R. guns, which now compose the field artillery of England.

Some few years ago it was stated, and doubtless with some truth, that heavy breech-loading cannon fired with a quickly burning powder would not stand the charge which it is necessary to give them; but now that pebble powder and other slower-burning powders have been invented, exerting a much less pressure on the gun, it would appear safe to reintroduce heavy breech-loaders, for there is no doubt, as regards heavy guns in battery and on board ship, that the breech-loading system saves, if not time and labour, certainly exposure. The introduction, however, of hydraulic power, and the strength of our M.L.R. guns, would seem to preclude any change at present.

Amongst other objections to the heavy breech-loader is the back smoke on opening the breech-cap; in the open air this does not appear to be an objection, and on board ship between decks, this drawback might be overcome, especially in a steam vessel, where the power of machinery is at hand to carry out any invention for getting rid of the smoke.

The continental powers for the most part prefer breech-loaders, light and *heavy*, and have adopted them for their *armament.*

The following guns will be found under their own heads:—

Austrian.
Blakeley.
Bloomfield.
Breech-loading.
Cavalli.
Congreve.
Dahlgren.
Dundas.
Fraser.
French.
German.
Italian.
Krupp.
Lancaster.
Macomber.
Millar.
Monk.
Muzzle-loading.
Painham.
Palliser.
Parrot.
Rodman.
Steel.
Steel-bronze.
Swivel.
Vavasseur.
Wahrendorff.
Wedge.
Whitworth.
Woolwich.

(*Vide* Appendix B.)

**Gun Ammunition Box,** *vide* Box, Gun Ammunition.

**Gun Aprons,** *vide* Aprons, Gun.

**Gun Carriage**—This nature of carriage is described under the several heads of carriages provided for warlike purposes.

**Gun-cotton**—An explosive substance, the invention of Professor Schönbein. It is prepared by soaking cotton in three parts of sulphuric acid (sp. gr. 1·85) and one part nitric acid (sp. gr. 1·45 to 1·50). The excess of acid is poured off and the cotton thoroughly washed in running water. When partially dried, it is washed in a diluted solution of carbonate of potass. Afterwards it is put in a press to free it of the alkaline solution, while at the same time the cotton is rendered nearly dry. The substance is then washed in a solution of pure nitrate of potass, and afterwards pressed and dried. The explosive force of Schönbein's gun-cotton is nearly three times greater than that of gunpowder. Some years ago, experiments were made in England with Schönbein's cotton, but it was found to explode so instantaneously that it was rejected for artillery purposes. Since then, however, General von Lenk, of the Austrian service, has discovered the means of giving gun-cotton any velocity of explosion, from 1 foot per second to 1 foot in $\frac{1}{1000}$ of a second, by opening out the cotton, and allowing it to occupy a larger space in the bore; by this means, it acts even more slowly than gunpowder.

Another mode of treating gun-cotton has been applied by Mr. Abel, the chemical examiner at the War Office, who has been able to use gun-cotton in a granular form, by first rendering it into a state of pulp, and afterwards forming it into grain similar to corned gunpowder. The experiments have shown improved results compared with former specimens of gun-cotton, but it has not as yet been perfected, so as to render it safe for use in artillery. For sporting purposes, gun cotton may be considered a success.

Several committees have had under their consideration the subject of gun-cotton, and all have reported as to its great value under certain circumstances, as will be gathered from the following results of experiments made at different times by different committees. The committee of which Colonel Gallwey, R.E., was the president, reported as follows:—"For the demolition of revetments and the formation of breaches by mines, gun-cotton is considered superior to gunpowder in the proportion of 5 to 2. For the demolition of single stockades, gun-cotton at the rate of 7 lbs. per linear foot of the stockade is effective, even where the timbers are from 12 to 14 inches square. In the demolition of double stockades, with 3 feet 6 inches between the rows, 25 lbs. of cotton per foot is required; in a trial with gunpowder, 200 lbs. failed to make a practicable breach."

The report was considered so satisfactory that it led to the use of gun-cotton for torpedo purposes.

For the hasty demolition of bomb-proof buildings, gun-cotton is also pronounced to be most valuable. It is equivalent to nearly six times its weight of gunpowder. For earth mines, however, and countermined works, it is not recommended. It does not exert in earth such an upheaving power as gunpowder, and the gases generated are injurious to the men working in the galleries. For these operations, therefore, powder will be used. For the removal and destruction of wrecks, rocks, and other obstacles to navigation, gun-cotton is also very valuable; and for torpedo purposes, Colonel Gallwey's committee follow the recommendation of the Floating Obstruction Committee, which in 1868 pronounced in favour of gun-cotton, as the result of some extended trials.

The exploding point of gun-cotton is about 343° Fahr., gunpowder being about 600° Fahr., a quality which is taken advantage of in using it as priming for fuzes when very small charges are used. Independent of its increased power, gun-cotton, when applied in the form suggested by Mr. Abel, viz. compressed and fired by a detonating fuze, has many advantages over gunpowder, among which its perfect safety stands prominent. Gun-cotton of this construction cannot be *exploded* unless confined in a strong case, or unless purposely fired by detonation. If a light be merely set to a mass of it, it will burn gradually and harmlessly away, without any explosive effect whatever. It may be made uninflammable by the simple process of storing it damp, and can be readily restored to a condition for use, or can be used in a wet state by means of a little dry cotton and a detonating fuze. Gun-cotton is cheaper than gunpowder, because, although per pound dearer, one pound of it goes as far as from four to six of gunpowder; it is also much lighter, and being weight for weight the same bulk, so much easier to carry. For submarine work the results obtained from several experiments show the same superiority under certain conditions for gun-cotton over gunpowder. Its ignition, at all times more rapid than that of gunpowder, is, when fired with a detonating fuze, immensely quickened, and the damaging effect of its explosion is much increased, both of which properties are in its favour.

In a recent report by a special committee on gun-cotton, of which Colonel Younghusband, R.A., F.R.S., then superintendent of the Royal Gunpowder Factories, was president, gun-cotton is pronounced "a most valuable explosive agent for military and naval purposes; that, as it is capable of being manufactured in a wet state, there is no danger attending the process; and that, as it can be stored wet, it can be safely conveyed on board ship or warehoused without risk."

It is found that gun-cotton, though

fired by detonation, is not exploded by being struck with a bullet. In these respects it is stated to have contrasted favourably with litho-fracteur and dynamite, which, although tolerably safe to store and transport when fresh, are not so secure under all circumstances.

Colonel Younghusband's committee advert to the experiments carried out by Mr. Brown, of the Woolwich chemical department, by which it was shown that it is easy to accomplish the detonation of compressed gun-cotton when in a very damp state, and even when so wet as to be absolutely uninflammable, by detonating some dry cotton in contact with it. One of the ordinary experiments to illustrate this remarkable property of compressed gun-cotton was carried out as follows:—"The operator takes a wet half-pound disc in one hand and a red-hot poker in the other. He then proceeds to bore a hole in the disc with the hot iron, showing that the wet gun-cotton is absolutely uninflammable. The wet disc is then laid on a large stone or piece of timber, with a half-ounce dry disc or "primer," in which a detonating fuze is inserted, in contact. On firing the detonator, the wet disc explodes with extreme violence, shattering the stone or timber."

It is also stated in the 'Treatise on Ammunition, 1874,' that "it is found that not only can dry gun-cotton be detonated by the action of fulminate of mercury, but also that the same effect is produced in wet gun-cotton if sufficient fulminate be used. A dry disc detonated by the usual amount of fulminate is however more convenient to start the action; a half-pound dry disc will be found sufficient to communicate the action to a large charge of wet gun-cotton. This is most important, as it allows of the use of wet gun-cotton in torpedoes, and also does away with the risk connected with storing dry cotton." It is further stated that, "when gun-cotton is detonated, its action is so very rapid that no confinement is required; thus there ceases to be any necessity for using a strong case for torpedoes, or for tamping mines, and it can be used to throw down stockades, &c. by simply attaching the discs loosely to *the obstacle.*"

The force of detonated gun-cotton is stated to be about four times that of exploded gunpowder, weight for weight.

The more the action of gun-cotton is considered, the more valuable it appears, especially for torpedoes and stockades; and the advantage of being able to store it damp, either in a magazine or in transit, without danger of explosion or detriment to its explosive power, renders it a most valuable composition. Trials have been made with gun-cotton as a detonator in shells filled with water, and most satisfactory results have been obtained. (*Vide* Water Shells.)

**Gun Factories, Royal**—Buildings appropriated in the Woolwich Arsenal for the manufacture of guns. Woolwich has long been a factory for the production of bronze guns; but these guns having ceased to be manufactured since the introduction of wrought-iron ordnance, guns only of the latter metal are now made. The success with which the manufacture of rifled guns of all sizes, up to the 81-ton gun, has been carried on speaks well for the manufacturing powers of the factory. (*Vide* Woolwich.)

Elswick, which was formerly an adjunct of the Royal Gun Factory, is now more of the nature of a contractor's foundry. It was originally set up by Sir William Armstrong & Co., engineers and founders, and in it was developed much of the machinery for making Armstrong guns; it would now possibly, as any other foundry might, furnish guns to the government if guns were wanted in greater number than the factory at Woolwich could turn out, the guns being sold at a contract price, payable after they had passed a rigid inspection. The government, as will be seen, has nothing more to say to this establishment than it would to any other of a similar nature, having withdrawn the government aid in 1863, on the payment of a certain sum to the company as compensation for the plant they had originally set up.

For the guns in the service, both rifled and smooth-bore, *vide* Appendix B.

**Gun-fire**—A well-known name in the army, proclaiming the break and close of day by the firing of a gun; in the former case troops turn out and prepare for the forthcoming duties of the day.

and in the latter all night duties commence. (*Vide* Tattoo.)

**Gun Metal,** *vide* Bronze.

**Gunner**—The name given to an artilleryman, obviously derived from the word "gun:" one who is practically acquainted with the working and use of guns. In the early days of artillery, as noticed in Captain Duncan's 'History of the Royal Artillery,' the gunner, as then known by that name, was not identical with the gunner of the present day, few of that denomination being attached to either train or battery, only one per gun, assisted by a matross (*q. v.*). In some degree the duties of the matross may at times have been similar to those of the gunner as now known. The men who were formerly attached to trains, as far back as the sixteenth century, were a class of men termed "artificers," who apparently were entertained more for the usefulness of their trade than for their knowledge of artillery. Probably they were found useful for the manual labour of the guns, in putting them into position and the like, while the gunners, who were few in number, took only a general supervision of the guns and stores, and the laying and firing of the pieces in action. By degrees, however, as the number of guns increased, so did the number of gunners, and except for the purposes for which artificers are employed, viz. to effect the repairs of the carriages of a train, the civil element died out, and the gunner became the useful and necessary man he has ever proved himself to be.

The duties of a gunner are very varied, and require long and careful training, with considerable experience. Not only has he to be instructed in drill, and in the service of the different natures of ordnance, heavy and light, of which rifled ordnance now forms the greater part, but he has to acquaint himself with the ammunition, the mode of using it, the care to be bestowed on it, and the several subjects which the laboratory alone can teach him, and which afford ample scope for industry. Gunners should be strong, active men, not too tall. This latter remark has reference especially to horse artillerymen. The rank of a gunner corresponds with that of private in the line.

**Gunner's Pendulum,** *vide* Pendulum, Gunner's.

**Gunnery**—The science of artillery theoretically and practically considered. *Theoretical gunnery* involves the determination of all problems having reference to the resistance of the air to projectiles. *Practical gunnery* implies the actual working, laying, and firing of guns, and the carrying out of what theory teaches.

It is only within the last few years that the theory of gunnery has attained its present state of perfection, enabling the artillerist, with the aid of the chronographs now in use, and from the results obtained with these beautiful instruments, to determine the most intricate questions on the flight of projectiles, either at the muzzle of the gun or at the several points of their path. The instruments now in use for calculating the velocity of a shot at the mouth of the piece, termed its *initial velocity* (*q. v.*), and at different periods of its flight, are Navez-Leurs' electro-ballistic apparatus, Le Boulengé's chronograph, Bashforth's chronograph, and Captain A. Noble's chronoscope (*q. v.*).

In our admiration of all that the science of gunnery teaches us, and the perfection to which it has attained, we should bear in mind the fact that to Robins and Hutton we owe our earliest lessons in this science, and to the latter the many valuable and practical rules which later experiments have tended to confirm.

It will be interesting to artillerists who may not be acquainted with the opinion of the Committee of Reference, given some years ago on the merits of Bashforth's instrument, to know the answers to the particular questions put by the committee, as contained in the following extracts of the report:—

"1. Whether it is now to be considered as proved that the resistance of the air varies practically as the cube of the velocity of the shot for all the velocities in use in gunnery, ranging from 300 to 1900 feet per second, or for what range of velocities; and if not true, whether it is nearer the truth than any equally simple law before propounded?

"*Ans.*—The law can only be regarded as approximately true for a limited range of velocities. The resistance varies most nearly as the cube of the velocity for velocities of about 1200 feet per second; for velocities much higher or much lower than this, the co-efficient of resistance varies considerably with the velocity.

"For velocities within a limited range the law may be regarded as giving sufficiently approximate results, provided the coefficient of resistance corresponding to the mean velocity be employed.

"This law is attended with the important practical advantage that the calculations required by it are simple, and the results to which it leads may be readily embodied in tables.

"2. Whether this law of resistance is to be regarded as a new one, the discovery of which is due to Mr. Bashforth?

"*Ans.*—The law was stated by Professor Hélie in his work published in 1865, and it appears to have been in use for some years before that time in the school of artillery of Metz; but Professor Bashforth, without being aware of this, independently deduced the same law from his own experiments, so far at least as the law can be considered true, viz. for a limited range of the velocity.

"Professor Bashforth, by his valuable experimental determination of the co-efficient of resistance corresponding to different velocities, has furnished the data which are absolutely necessary in order to make the law applicable in practice.

"3. Whether the instrument devised and perfected by Mr. Bashforth for recording successive small intervals of time is susceptible of general employment at schools of instruction in gunnery?

"*Ans.*—Mr. Bashforth's instrument is simple in principle, easy to work with, and not readily liable to get out of order, and we think it well adapted for general employment at schools of instruction in gunnery.

"4. Whether any means of solving the same problem with equal precision existed before?

"*Ans.*—We do not think that any means existed before of recording a number of successive small intervals of time with the degree of precision and trustworthiness attained by Professor Bashforth's instrument."

**Gunny**—A coarse Indian cloth manufactured largely in Bengal. It is of two kinds for artillery purposes in that country, *single* and *double*; the former is used for charcoal bags, for package of gunpowder barrels, and as package generally; the latter for slings for carrying shot and shell, and small-arm ammunition boxes, also for covering ammunition boxes, making sand-bags, &c. The saleetahs and pin-bags for tents are also made of gunny. The material from which this article is manufactured is the fibre of two plants of the genus Corchorus, i.e. *Corchorus olitarius*, and *Corchorus capsularis*; both, but particularly the first-named plant, are extensively cultivated throughout Lower Bengal. This nature of cloth is universally used for bags of all sorts, and there is a very large exportation of this material to America, the Coromandel and Malabar coasts, and Singapore.

**Gunny Bags**, *vide* Bags, Gunny.

**Gun-pits** — Excavations made in the earth for the protection of artillery in the field, when shelter is necessary. The guns may be often covered from the enemy's fire by natural banks, crests of hills, sand mounds, &c.; but if there be no natural cover, resort must be had to the pickaxe and spade. A gun-pit can be excavated in one hour by experienced men. This gives but a limited space to the gun detachment, so if there be time the pit can be lengthened, and the thickness of the parapet increased. Since isolated gun-pits, as explained in the first volume of 'Instruction in Military Engineering,' would form good marks for the enemy's fire, it would be advisable to connect them by shelter trenches, in which, however, places should be left to enable the guns to pass readily to the front. Should no natural cover whatever be available for the limber, cover for it and a pair of horses might be provided in a pit, somewhat of the form of a charger-pit, and similar arrangements should be made for the cover of more horses.

**Gun Platform**, *vide* Platform.

**Gun Portion**—In fortification, is half of the merlon on each side of the gun, that is to say, 9 feet on one side of the embrasure and 9 feet on the other.

**Gunpowder**—An explosive substance; the motive or propelling force of projectiles from ordnance and small-arms, which, on being inflamed, generates an elastic force capable of throwing shot and shell to enormous distances. Gunpowder appears to have been known from a very early date both in India and China, long before it was known in Europe. Saltpetre abounds in those countries, and though the value of it in connection with charcoal may not have been known as a propelling power, advantage was taken of it to form the mysterious fires so often alluded to in Eastern books. Fireworks and rockets seem also to have been largely and commonly used; but, for artillery purposes, the value of gunpowder does not appear to have been realised at so early a date: in India, not until about the reign of Akbar, when the art of gunmaking was received from Europe. In Europe, gunpowder was unknown till about the year 1320, and the discovery is attributed to a German monk named Schwartz, though there is reason to believe that our countryman, Roger Bacon, knew of it a century earlier; however, if he did, little advantage seems to have been taken of the discovery till the fifteenth century, except with hand guns. From this period great strides in artillery were made, especially in France.

The following is a short and general description of the manufacture of gunpowder.

Gunpowder is formed from the intimate mixture of three ingredients, saltpetre or nitre, charcoal, and sulphur, in the proportion, as made at the present day in English factories, of 76,* 15, 10. Saltpetre, before being mixed with the other ingredients, should be perfectly refined and free from all impurities, especially deliquescent salts, such as chloride of sodium. Charcoal should be made as it is wanted, and used soon after, from its liability to imbibe moisture if kept any time in store; but except for this reason, there appears to be nothing against its being used for gunpowder purposes at any time, as long as the analysis shows it to possess the properties of a good charcoal, when all that is necessary, in weighing out the charges, is to make an allowance for the moisture, by adding an equivalent in charcoal. Good charcoal should burn without leaving any residue; it should be light, sonorous, and easily pulverised, and, when broken, should have a velvet-like appearance; further, it should be soft and friable—so soft as not to scratch polished copper, and ought not to exhibit any alkali when treated with pure distilled water. The sulphur should be as pure as possible, and, to obtain it in this state, it should be fused or treated by distillation.

The three ingredients, having been brought together, are first mixed in a mixing machine, then transferred to the incorporating house, where they undergo, from the peculiar motion of the machinery, a grinding, twisting, and a mixing action, until formed into what is termed "mill-cake;" during this process distilled water in certain proportions is added, ordinary powder taking about 3 per cent., pebble powder from 3 to 6 per cent., according to the state of the weather. From thence the powder in this state is taken to the "breaking-down house," in order that the cake may be broken into a convenient size, before being taken to the press house, where it is subjected to hydraulic pressure, so many tons to the square foot, varying with the nature of the powder. The pressure given to pebble powder varies with the seasons, and as a rule it has been found that density is more easily obtained in summer than winter, owing to the more effectual incorporation. The press-cake is now broken up and transferred to the granulating house, to be there formed into the several-sized grains required for the different natures of powder; it is also partially dusted in this house. After this process, the powder is taken to the dusting house, to free it still further from the small particles of dust remaining amongst the grains; this being completed, it is glazed, then dried for 24 or 36 hours, according to the nature of the powder, and lastly dusted again, before being examined, proved, and barrelled up.

---

* This extra pound of saltpetre *is given to make good wastage.*

The great object to attain in making gunpowder is to produce equal results from equal quantities of the manufacture, but this, for various causes, cannot always be relied on; hence the unequal practice sometimes observed with the same charges and from the same piece. The density of R.L.G. powder should not be less than 1·68, and not more than 1·75, and R.F.G. 1·55 to 1·65.

During the year 1873 a powder designated R.F.G.$^2$ was approved for use with the Martini-Henry rifle. It differs from R.F.G. powder in the following particulars, viz.:—

1. The charcoal is burned about 2 hours longer.
2. The composition is milled about twice as long.
3. The meal is pressed into cake of considerably greater hardness.
4. The foul grain is glazed about twice as long.

The size of grain of both powders is the same, viz. between $\frac{1}{12}$ and $\frac{1}{20}$ of an inch.

In consequence of the greater hardness and density of the grain of R.F.G.$^2$ powder, it will keep better than R.F.G., and will dust less in manipulation and transport.

The part that each of the ingredients performs in the inflammation of gunpowder is thus explained in Abel and Bloxam's 'Handbook of Chemistry':—"The action of this substance as a propelling agent is dependent upon the rapid oxidation of the charcoal by the nitre, and the consequent sudden evolution of a large volume of heated gas. In a mixture of nitre and charcoal alone, the oxidation (deflagration) proceeds with comparative tardiness; the addition of sulphur greatly augments the combustibility of the mixture (in consequence of the lower temperature at which it ignites): the sulphur by its presence also renders available for the oxidation of the carbon an extra amount of oxygen—namely, that which is united with the potassium, the latter being at once converted into sulphide upon ignition of the powder. The temperature at which gunpowder ignites is about 600°."

When it may be necessary to separate *the three ingredients* of which gunpowder is formed, the following method can be pursued:—

### *First, for Moisture.*

Weigh accurately in a watch glass 50 grains of gunpowder, and place the same in a *water-oven*, which should not exceed 150° in temperature. until perfectly dry (say about an hour). Then remove it, and place it in the scales; the difference of weight in its cold and hot state will be the moisture required. Deduct ·01 of a grain for the difference of temperature of the glass between its cold state and the degree of heat in it when it again reaches the scales, which between the oven and the scales will, to a certain extent, be lower than that of the gunpowder. Multiply by 2 for the percentage to make up 100 grains.

### *Second, to extract the Saltpetre.*

Weigh as before 50 grains of gunpowder, and place the same in a glass beaker, mixing it with hot water, which place on the water-oven for about an hour. Decant the same in a *known* filter placed in a glass funnel, and frequently wash the filter with the *wash bottle*, so that no trace of saltpetre be left in it. Take the filtrate, which now contains a solution of saltpetre, and evaporate it over the oven. When evaporated, weigh the result, which, multiplied by 2, should give nearly the original quantity of saltpetre with which the gunpowder was made.

### *Third, to ascertain the Weight of Sulphur and Charcoal together.*

Weigh, after the saltpetre has been extracted, the sulphur and charcoal left in the filter. This is effected by placing the filter with its contents on the oven to dry, and afterwards enclosing it in a glass tube corked down, the weight of the tube, cork, and empty filter in their cold state having been previously ascertained. Deduct then the weight of the tube, cork, and empty filter from the weight of the tube, cork, and filter with its contents, and the difference will be the weight of the charcoal and sulphur.

### *Fourth, to extract the Sulphur.*

Take 20 grains of gunpowder, 20 grains of pure saltpetre, 20 grains of carbonate of soda, and 80 grains of chloride of sodium (common salt). Mix these all together in a crucible, and place the same on a charcoal fire, until the mass becomes perfectly white; then remove it, and put it with the crucible into a beaker of cold water. Place the beaker on the *water-oven* until the mass dissolves, then filter. The filtrate is now heated, and acidulated by hydrochloric acid until all effervescence subsides. Then pour in a few drops of chloride of barium, from time to time, which will cause the sulphur in the solution to be precipitated. The solution in the beaker is now passed through a filter, and the contents of the filter (which is now sulphur alone) dried and weighed, and deducted from the sum of the charcoal and sulphur previously thus computed, leaves the charcoal required. A more efficacious mode of extracting the sulphur is with bisulphide of carbon.

The sum of the three ingredients, with the moisture, should make up 99·86 of 100 grains, the slight difference being supposed to have escaped during the process of separation, in the form of nitric and sulphuric acid gases.

**Gunpowder Factory**—Consists of buildings in which the several processes in the manufacture of gunpowder are carried out. A gunpowder factory should be situated far away from inhabited localities. The buildings should be made of wood, so that in case of explosion the smallest resistance would be offered to the force of the powder. Explosions under any circumstances are disastrous, but, if they occur in a masonry building, are still more so. The generality of mill-houses, therefore, will be found to be made of wood and protected from one another by huge banks of earth or thick masonry surrounding each house. There is no objection to making incorporating houses of masonry if the walls be built thick enough to withstand the explosive force of a "mill charge" (50 lbs.). To add to the safety of incorporating houses, in case of an explosion in one room, the charges in the other rooms are by means of self-acting machinery instantaneously drowned in water.

The principal, indeed the only government, factory for the manufacture of gunpowder in England is at *Waltham* Abbey. All powder required in excess of what this factory is able to turn out is supplied by private factories on contract. In India there are three factories, one in each presidency.

**Gun Sling**, *vide* Sling, Gun.

**Gun Tackle**—An arrangement of blocks and ropes for the use of raising and lowering guns. There are two of this name used in the artillery service. One consists of two double blocks, called a *gun tackle*, the other a *heavy gun tackle*, consisting of a double and treble block. In the former, the power is increased fivefold when the standing end of the *fall* is made fast to the movable block, and fourfold when made fast to the other. In the latter, the power increases five or six times, as used. (*Vide* Tackles.)

**Gunter's Chain**—A chain used by surveyors for measuring land, and called after its inventor. It is 66 feet long, and its convenience turns on the fact that 10 square chains make 1 acre. The chain is divided into 100 links, and thus 100,000 square links make 1 acre.

**Gunter's Scale**—A mathematical instrument on which lines and figures are marked. The name of this scale is usually given to three lines to be seen on almost any sector, and marked N. S. T., meaning the lines of logarithmic *numbers*, of logarithmic *sines*, and of logarithmic *tangents*. To understand its construction and use requires a knowledge of logarithms: they are explained in every school-book of practical mathematics.

**Gusset**—A piece at first of chain and afterwards of plate armour, intended as a protection to the vulnerable point where the defences of the arm and breast left a gap.

**Gutta-percha**—As explained in Balfour's 'Cyclopædia of India,' is the concrete juice of a forest tree, a native of the shores of the Straits of Malacca, Borneo, and the neighbouring countries. The tree is from 60 to 70 feet high, and 3 or 4 feet in diameter. Boiling appears necessary when the juice is collected in large quantities, but when a small quantity is allowed to exude from a freshly wounded tree, and is collected and moulded by the hand, it consolidates perfectly in a few minutes, and has all the appearance of the prepared article. Gutta-percha, when quite pure, is greyish white, but it is generally brought to market of a reddish brown hue. The great peculiarity which makes gutta-percha convenient and valuable for a variety of purposes is that, when plunged into boiling water, it becomes so soft and plastic as to be easily moulded into any desired form, and this form it permanently retains on cooling. It is on this account used in the artillery service to take impressions of the bore of a piece of ordnance which exhibits flaws or cracks after firing. But its most important application has been in the coating of marine electric telegraph wires.

**Guy Ropes**—Are steadying ropes fastened to the heads of spars, sheers, derricks, gyns, &c.

**Gymnastics**—The art or method of exercising the body to make it active, supple, and capable of bearing much fatigue. It comprises athletic exercises—fencing, swimming (where opportunities exist), broadsword, bayonet, and running exercises—all of which now form part of the instruction given in setting up the British soldier.

**Gyn** — A machine for lifting heavy weights, and especially for mounting and dismounting ordnance from their carriages, &c. Gyns were formerly constructed only of wood, but are now also made of wrought iron. The gyns in use for garrison service are termed *triangle gyns*, of which there are four, designated *light* and *heavy*, both 18 feet in height. Two are made of wood and two of iron, and are capable of raising from 7 to 12 tons.

A gyn consists of a prypole and two cheeks with cross bars, with a windlass fixed between them, forming the figure of a triangle when set up, hence its name, *triangle gyn*. An alteration in the service gyn was proposed by Colonel Hay, R.A., which did away with the shackle. It consisted of fitting the prypole with an arched and forked end, which permitted of the upper block of the tackle being hooked to the bolt between the forks of the pole. This arrangement has the advantage of allowing the gun to be raised to greater heights than in the service gyn. Another gyn in the service, the *Gibraltar gyn*, is of a different shape to the triangle gyn, and is used for mounting and dismounting ordnance in situations where the triangle gyn, from its height, could not be conveniently placed. This gyn is not capable of lifting more than 3 tons.

**Gyration, Centre of**—Is that point of a system of bodies round an axis in which, if all the matter of the system were collected, the same moving force would produce the same angular velocity in the system.

**Gyroscope**—Is thus described:—"An instrument invented by M. Foucault to render palpable to the eye the earth's rotation. Its success depends on the principle, that if a mass be set in rotation freely in space, it will, unless disturbed or constrained, preserve absolutely the plane of its rotation, and will, to effect this, even overcome slight obstacles."

## H.

**Habergeon**—A short coat of mail, consisting of a jacket without sleeves. In early times the habergeon was composed of chain mail; but in the fourteenth century a habergeon of plate armour was worn over the hauberk. The word habergeon, we find, is used four or five times in the Old Testament.

**Hachures** (French = strokes)—In military drawing, are strokes, or a species of shading, by which the relief of the ground is shown. Hachures are of two kinds, *vertical* and *horizontal*.

**Hackbutt**, or **Hagbutt**—Another name for an improved kind of arquebus, and known about the beginning of the sixteenth century.

**Hackery**—An Indian cart, used generally in the Bengal presidency for the carriage of country produce, and often in the transport of government stores.

**Hacqueton**, *vide* Aketon.

**Hair-cloths** — Cloths made of horse hair. They are placed upon the floors and tables of magazines, or buildings in which powder is stored or handled, to prevent accidents from grit. They are also laid down on a jetty to roll powder barrels on, or to cover powder barrels in transit, for which purpose they are better suited than for any other.

**Halberd,** or **Halbert**—A weapon introduced about the middle of the fifteenth century; halberdiers appear for the first time amongst the English infantry in this century. Halberds were, at a later period, and up even to the end of the first quarter of this century, used by the sergeants of infantry and artillery. Its shape was that of a spear, with a shaft about 5 feet long, the head of which was mounted with a steel point. Besides this it had a cross piece of iron attached to it, which enabled the halberdier to cut as well as to thrust. It is said to have been originally used by the Danes.

Another use the halberd was put to, viz. when soldiers were flogged. Several were heaped together, and the soldier was lashed to them, hence the saying, "I'll send you to the halberds."

**Hale's Rockets,** *vide* Rockets, Hale's.

**Half-batta,** *vide* Batta.

**Half-battery**—In artillery, a portion of a field battery, consisting of three guns with their wagons.

**Half-pay**—Is defined as follows in the Queen's Regulations:—"Every officer under 25 years' full-pay service, who from wounds or ill-health contracted in and by the service shall become unfit for duty, and who shall be desirous of retiring temporarily upon half-pay, is to transmit his application to the Military Secretary, through the commanding officer, accompanied by a certificate of a board of medical officers, explaining the cause of his becoming unfit for service." This is termed *temporary* half-pay. But there is also in the service what is known as *permanent* half-pay, and this is accorded to every officer who has served 25 years; it is also given to all field officers who, after serving for 5 years in the rank of major or lieutenant-colonel with a regiment, are not re-employed. Half-pay was instituted in the reign of William III.

**Half-wrought Materials**—In artillery, consist of the several parts of gun carriages in the rough, or *partly shaped to* the form required. Supplies of these materials are kept in every arsenal, and are issued to batteries on indent. Each battery in the field is allowed the following half-wroughts:—

| | |
|---|---|
| Beam .. .. | 1 |
| Cheeks . .. | 2 |
| Perch wagon .. | 1 |
| Splinter bar .. | 2 |
| Shafts, spare .. | 2, complete. |
| Felloes .. .. | 12 |
| Spokes .. .. | 24 |

But as a spare carriage is allowed, there is no necessity to carry such ponderous articles as beams, &c.; the officer commanding a troop or battery will, therefore, use his discretion, according to the nature of the service on which he may be going, as to what half-wrought materials he will carry, any in excess of the number allowed being provided at his own expense. On leaving a station where there may be an arsenal, he can, if he thinks fit, return into store such half-wroughts as he may not wish to carry on the march, receiving from the ordnance officer a receipt, which will be his voucher for obtaining others free of charge at the next arsenal.

The above instructions have reference to the artillery in India, wherever the carriages are of the old pattern, viz. of wood. The new field carriages being made of iron, the supply of half-wroughts as shown in the above list is not required, except for the wheels and other wooden parts of the carriage.

**Halt**—Literally, to stop; a term well known to soldiers. It is the word of command given to a body of men, or to a regiment or an army, on the move, to discontinue its march.

In the march of a body of soldiers halts are very necessary for the comfort of the men, to enable them to rest themselves. On the usual daily march of a regiment in India, halts are made halfway, and coffee is served out to the men. This is a very desirable arrangement, seeing how early a regiment commences its march in that country.

**Hambro' Line,** *vide* Line, Hambro'.

**Hames**—Two pieces of iron encircling a horse's collar, connected at the bottom by an iron loop, and at the top by a strap and buckle. Attached to the hames are iron lugs to which the traces are linked.

**Hammer** — An instrument in very general use for driving and drawing nails, beating out metals, &c. There are various kinds of hand hammers, which are used for different purposes. Their weights are variously estimated.

The same name is given to one of the parts of the lock of small-arms.

**Hammer, Claw,** *vide* Claw Hammer.

**Hammer, Cooper's**—For heading and unheading powder or ammunition barrels, and performing such coopering operations in a magazine, or wherever powder is being handled, as may be required. Only copper or wooden cross-head mallets are allowed to be used for such purposes.

In heading or unheading powder barrels, the persons employed are not allowed to use the bare adze against the copper hoops, but are invariably to apply a driver.

**Hammer, Sledge** — A large hammer used by the blacksmith when the object to be forged is not very large. The weight of a sledge-hammer is from 10 to 14 lbs., although sometimes even more. The sledge-hammer is wielded by the fireman's assistant, who is termed the hammer-man.

**Hammer, Steam** — As described in Weale's 'Dictionary,' "is employed instead of the old helves or lift-hammers, and is worked by a connected high-pressure steam-engine, which raises the hammer to any required height within its vertical range of motion, in which it is guided by two planed guides. On the escape of the steam, when the valve of the cylinder is opened, the hammer falls on the work that lies on the anvil with the full force due to gravity, with scarcely any loss from friction. The instant the hammer has given its blow, the steam is again let in under the piston, and the same action is repeated with ease and rapidity." This hammer is the invention of Mr. Nasmyth. In the first hammers that were used, the weight of the descending mass—viz. the hammer-block, hammer, &c.—was from 30 to 60 cwt., but it is now almost as many tons. The Nasmyth hammer in the gun factory *at Woolwich* has a descending weight of 40 tons. It is used in the manufacture of the large coil guns, and is worked with the ease and precision of the merest toy.

**Hammer, Tilt**—Used in forging implements and tools, such as shovels, spades, mattocks, and cleavers.

**Hammer, Wrench** — Used to tighten and loosen nuts and bolts; it can, from its construction, be adjusted to any required size. This nature of hammer has a turn-screw attached to it.

**Hammock**—A kind of bed suspended, on land, between trees or posts; on board ship, between hooks. Each soldier proceeding to sea on board a troop or transport ship is entitled to have a hammock told off to him as his resting-place of a night.

**Hand**—A measure of 4 inches. The height of a horse is computed by hands.

**Hand-axe** — One of the implements used by the pioneers of a regiment.

**Handcuff** — A fetter to secure the hands together. Handcuffs are made of iron, ring-shaped, with a lock attached, and just large enough to keep on the wrists without hurting them.

**Hand Grenades,** *vide* Grenades.

**Handguns**—As used in former days, and as the name imports, were synonymous with what we now term "small-arms," but very rude in construction and of considerable weight. They were introduced in the early part of the fifteenth century. They are thus described: — "Handguns had, as already mentioned, been used at the siege of Arras, in the year 1414, and in this reign they were coming into more general use; but they were very rude in construction, being formed of a simple iron tube with a touchhole at top, fixed in a stock of wood about a cubit and a half long, and called the frame of the '*gonne*.' The pan, it appears, was subsequently added to prevent the priming from falling on the ground."

**Handles, Limbering**—The iron handles on each side of the trail of a gun carriage to assist in limbering up the gun to the limber.

**Hand-rubbing** — The manipulation which horses' legs undergo on the march and elsewhere, chiefly at feeding time, and which should he continued for about 20 minutes at each meal.

**Handsaw** — A carpenter's tool for

cutting asunder wood which would be too thick to be cut by an adze, or which requires accuracy in cutting.

**Handspike**—A lever of the first order. There are several descriptions of handspikes in the service, many of which are used in the artillery for running up gun carriages, raising or turning heavy stores, slinging ammunition boxes, traversing guns and mortars, and for all purposes where leverage is required to be used.

**Handspike, Bevelled,** *vide* Bevelled Handspike.

**Handspike, Traversing**—A handspike attached to the end of the trail of gun carriages. It is movable, and, when the gun is not in action, is strapped on the surface of the carriage.

**Hang Fire, To**—The term is applied when a gun is slow in discharging itself, from the flame being checked in its passage to the charge, either from the vent being fouled or the charge being damp. The former can scarcely happen now, as the friction tube conveys the flame to the charge with great certainty.

**Harass, To**—In a military sense, is the act of annoying and incessantly pursuing or hanging on the rear and flanks of a retreating force, so as, if possible, to prevent its attaining its object, and perhaps overcoming the enemy altogether. Notwithstanding the disadvantage which a retreating army has under these circumstances, history affords us examples that if the retreat be conducted by an able commander, he has it in his power, by his ingenuity and other military qualities, to avoid the enemy, by getting into inaccessible places, or by so disposing of his troops as to make it hazardous for a pursuing army to follow him up, or any longer to endeavour to harass him.

**Harness**—The furniture or trappings of horses, esepcially of draught horses. The term was applied in the very earliest ages to body armour as well. The origin of harness can be traced back to a very remote date. We observe in ancient pictures, and in the description of ancient ceremonies and games, such as the Olympic games, that horses were attached to carriages with harness, of what kind and description no writings tell us, varying, undoubtedly, *according to the ideas* of the several nations which used it. The present mode of harnessing horses to gun carriages is only of a comparatively late date. The usual manner was to place one horse before the other, similar to the custom still observed in the country carts in our own land, the driver dismounted, and walking alongside his horses. This, however, was found to be awkward when quick movement was required, and moreover, on the march with a long line of carriages, took up a great deal of space. The idea then came to harness the horses two and two abreast, and ultimately to mount them instead of driving them on foot. This now is the custom in all artilleries. In the English artillery, shafts are used, and to each gun carriage the number of horses is regulated according to the weight they have to pull, each horse of a team of 4 horses being able to draw 6 cwt., or 24 cwt.; a team of 6 horses, 5 cwt. each, or 30 cwt., and thus decreasing rapidly in their power of draught, so that when each horse can only draw 4 cwt., no advantage is gained in employing a greater number of horses than 12 for the heaviest load in the service. The harness for the off-wheel or shaft horse is somewhat different to that for the leading horses, loops or lugs having to be attached to the chaise saddle for the support of the shafts.

Harness for the use of the artillery in India is after the same pattern as that issued at home, but it is made up in the country, the Indian government having establishments for that purpose. Harness is issued unblacked, and is kept in order by a mixture of bees-wax, mutton suet, and spirits of turpentine, which should be well and frequently rubbed in; the whole to be hand-rubbed daily.

Harness for man draught is occasionally required. It consists, as described in the 'Treatise on Military Carriages,' of white rope, with a hook at one end and an eye at the other, and fitted with web loops to go over the men's shoulders. The harness is *heavy* and *light*, and would be used when guns get into a difficulty and require assistance, or when there is a deficiency of cattle.

In harnessing elephants to heavy guns, one elephant goes in the shafts, a second leads, and if a third be necessary, the animal assists by pushing from behind.

**Harsegaye**—A kind of demi-lance, introduced in 1114.

**Hauberk**—A military tunic or vestment worn by the Saxons and Normans at the Conquest. It was covered with iron rings either laying flat on the coat or standing up edgeways. The dress was used by the Saxons, as early as the eighth century, as defensive body armour, and called by them the tunic of rings, but by the Normans the *hauberk*. Colonel Luard, in his work on 'The Dress of the British Soldier,' states that, besides the hauberk of rings, there are some marked with transverse lines, so as to give the idea of being quilted, or stitched in chequers, or covered with small lozenge-shaped pieces of steel instead of rings, known about this period, A.D. 1066–1087, by the name of mascled armour, from its resemblance to the meshes of a net. Other descriptions of armour were in use, and in some instances the hauberks appear to be composed of rings and mascles mixed; in others, the body is diamonded, and the cowl and arms covered with rings.

On referring to a work entitled 'The Conqueror and his Companions,' by Mr. J. R. Planché, Somerset herald, the hauberk as worn by William the Conqueror is thus spoken of:—"In the Bayeux tapestry we behold him armed in his hauberk, which was not the coat of chain mail of the thirteenth century, but the *geringhed byrnie* of the eleventh and twelfth, consisting of iron rings, not linked together and forming a garment of themselves, but sewn or strongly fastened flat upon a tunic of leather or of quilted linen, buckram, canvas, or some strong material descending to the mid-leg, and which, being open in the skirts both before and behind for convenience in riding, gave it the appearance of a jacket with short breeches attached to it, if, indeed, such was not actually the case in some instances. The sleeves were loose, and reached only just below the elbow."

**Havildar**—A non-commissioned officer attached to a native regiment of infantry in India; his position is similar to that of a sergeant in a European regiment.

**Havildar-Major** — The sergeant-major of a native regiment of infantry.

**Havresack** (French, *havre-sac*) — A canvas or linen bag issued to every soldier on a march, for the purpose of carrying provisions, odds and ends, &c. It is carried on the left side by a strap passing over the right shoulder, and is only used in the field or cantonments.

**Hawser**—A rope made of three strands; it is coiled up right-handed, or what is termed "with the sun." It is one of the ropes used in lifting ordnance.

**Haxo's System** — A system of fortification introduced by a distinguished engineer of that name, who served under the first Napoleon. He is known to English engineers, chiefly, as the inventor of casemated batteries *à l'Haxo*. These batteries have earthen parapets along their front, and their arches are well covered with earth. They are open to the terreplein in the rear, and there are apertures in front of the guns, opening into embrasures formed in an extension of the parapet at these points, beyond its ordinary retired position. Being open to the rear, the circulation of air prevents any inconvenience from smoke.

Batteries of this nature are to be found in many of our new works.

**Hay**—Grass cut and dried; the forage given to horses in Europe. In India, grass, in lieu of hay, is issued to all cavalry and artillery horses. Surplus grass is stacked, and used when there is a deficiency of green grass.

**Head-quarters**—Generally understood to mean the residence of the commander-in-chief, whether in camp or elsewhere. It is also applicable to the place where the officer commanding any independent position or body of troops resides.

**Head, Sponge**—In artillery, the top of the sponge staff. It consists of a block termed the *head*, upon which the wool to form the sponge is fastened either by the process of *thrumming* or *wigging* or some simpler mode.

**Head-stall**—In harness, that part of the bridle which encompasses the horse's head.

**Heavy Cavalry**—Commonly known as the *heavies*. They receive their name in contradistinction to the light cavalry, from their equipment and weight being greater than the latter. In the British service there are 7 regiments of *heavies*, viz. the dragoon guards. The weight the horse of the *heavies* has to carry is over 19 stone.

**Hedge**—An enclosure of small shrubs or trees set round a field. In certain military positions, hedges are often taken advantage of to form obstacles as well as cover against an advancing foe. To render them valuable, they may be strengthened in the several modes laid down in the Chatham course:—

"Strong hedges form one of the best obstacles that can be found, and with comparatively little labour can be made to afford good cover for the defenders. Hedges that can be easily enfiladed by artillery fire should not be selected for defence. Their efficiency may be increased in any of the following ways:—

"When the hedge is more than 6 feet high, weak parts should be strengthened by weaving in branches cut off above that height. A ditch of any section (say 3 feet deep, 8 feet wide at bottom, and 10 feet at top) should be excavated, 2 feet in front, the earth from it thrown over and laid against the hedge, forming a parapet with a banquette."

"If time presses, the earth may be obtained from a trench of similar sections, 12 feet in rear, or partly from front and partly from rear.

"When the hedge is situated on a steep slope, the earth should be taken from a trench in rear.

"If only half an hour be available, a trench 2 feet deep and 3 feet wide could be dug in rear, and the earth thrown up against the hedge, so as to form a breastwork, behind which cover can be obtained by stooping. For the sake of concealment, the branches should not be cut.

"When the hedge is under 6 feet in height, a small ditch should be dug in front, and the earth thrown over the hedge, a trench in rear being also made to provide the necessary cover.

"If there be a ditch in rear of a hedge, a very small amount of labour may provide cover."

**Heliograph**—An apparatus (the invention of Mr. H. C. Mance) for telegraphing by means of the sun's rays. It is composed of a circular mirror, varying in diameter, according to whether it be for field or for fixed *observations;* this mirror revolves on a horizontal axis, and is adjusted to the required angle of incidence with the sun, in connection with a telescopic rod. By means of adjusting screws, the rays of the sun can be made to fall upon any given point with the utmost precision. The mirror can be raised and depressed by a vertical rod placed at its back, and thus the flash occasioned by the rays falling upon it can be made, according to the wish of the operator, of any length, varied or grouped, representing letters or words composing the messages. Mr. Mance has adopted for his sun-telegraphy the Morse system of dashes and dots; and in India, where this apparatus has been in use for some time, its working has been attended with complete success, the range of signals being very great, and their intelligibility absolute. They can be read in ordinary weather without telescopes up to 50 miles, and during experiments made in this country, in clear weather, messages were signalled and visible to the naked eye up to 80 or even 100 miles. (*Vide* Telegraphy.)

**Heliostat**—An instrument by means of which the rays of the sun can be flashed to great distances. This instrument was invented by Gauss in 1821. It consists of an adjustable mirror as reflector, worked in connection with a combination of telescopes, and is now used in all trigonometrical surveys, and by its aid triangles having sides over 100 miles in length can be formed and measured.

The heliostat used in Great Britain is that invented by Captain Drummond, R. E., an improvement on S'Gravesande's and Colonel Colby's instruments. It consists of an equatorial, revolving on its polar axis, so that the sun, when once accurately in the focus of the telescope, continues *steadily fixed there.* This instrument is very similar to that known by the name of *heliotrope.*

**Heliotrope,** *vide* Heliostat.

**Helix** — Any thing of a spiral form, whether in one plane, as the spiral curve, or in different planes, as the screw.

**Helmet**—Defensive armour for the head. Anciently helmets were of two kinds, *open* and *closed,* with ornaments on the top of them. The former only covered the head, ears, and neck, leaving the face open. The latter enclosed the face, besides having perforations on the front of it for the admission of air, and slits also to admit of the wearer being able to see; this part was styled the *visor*, which could be lifted up. The helmet with ornament at top appears to have been first worn at jousts or tournaments.

The helmet is still worn in certain cavalry regiments. In India a helmet made of cork is the universal head-dress for officers of the staff, artillery, and native army; and a wicker one, covered with white cloth, for the troops.

**Helve** — The wooden handle of entrenching tools, such as axes (felling and pick), hatchets, kodalies, shovels, spades; also the handle of certain artificers' tools, axes, and sledge hammers.

**Hemp** — The fibre of certain plants grown both in Europe and India, known as the *Cannabis sativa* and *indica*, which have been pronounced identical plants. Balfour's 'Encyclopædia' gives the following description:—" In various notices of Indian fibres, we frequently meet with the word *sunn* as indicating a particular kind of hemp. Sometimes we find it called Indian hemp, and we may often see hemp enumerated as one of the exports from India, at other times we may see either the same or another fibre mentioned by the name of brown hemp. These various names are sometimes applied to the fibre of one or two different plants, or are employed to distinguish the fibre of three distinct plants, all of which are grown for their fibres, and have been and might be exported from India; though only two of them are now usually to be found among the exports from that country. Hence, to avoid ambiguity, it is necessary to notice the plants to which these several names are correctly applicable.

" The true hemp (*Cannabis sativa*), *gunja* of the natives, is everywhere cultivated in the plains of India, not on account of its fibres, but for its intoxicating leaves and their secretions. In the Himalayas, however, the fibre is separated for economic purposes, and was exported from India to England during the last war, and this has been the case for many years. The fibre of the *sunn* or *taag* (*Clotalaria juncea*) is often called Indian hemp, but incorrectly. It is the kind most generally cultivated all over India on account of its fibre, and is that usually mentioned in the exports from Calcutta under the name of hemp, but also as *sunn*. The plant may be distinguished by its flowers being of a bright yellow colour, and of the form of the pea and of the laburnum, while the leaves are entire and lanceolate. The fibre alluded to is very valuable for cordage, canvas, twine, &c. Madras and Bombay both export large quantities of hemp."

**Henchmen**—Soldiers who guarded the king's person in the time of Henry VIII.

**Herald**—A public officer, whose principal function was formerly to declare war, publish peace, &c. Nowadays heralds are only used on certain state occasions. The Lancaster herald, at the Herald's College, is inspector of regimental colours.

**Hero**—In the present acceptation of the term, a person distinguished for acts of valour. Amongst the ancients the name was accorded to men who became illustrious in war, and who were styled demi-gods, from a general notion that their actions entitled them to a place in heaven immediately after their decease.

**Herse**—In fortification, is a kind of gate or portcullis, with iron bars like a harrow, set in with iron pikes, placed above gates and lowered, to impede the advance of an enemy.

**Hide-bound**—Applied to a horse, signifies that his skin cannot be pulled up or raised from his ribs and back; caused from bad keep, poverty, internal disease. The remedy consists in good grooming and diet, with gentle medicine, and keeping the animal warm.

**Hides**—The skins of buffaloes, cows, bullocks, and other animals. Buffalo hides are used in India for the manufacture of buff accoutrements, belting of machinery, &c.; bullock or cow hides for mending cartouches and priming pouches, and a variety of other leather work. For the preparation of hides, *vide* Leather.

**Hides, Tanned, Powder** — Buffalo hides which have undergone the process of tanning. They are used for covering the floors of powder houses and charge magazines.

**Highlander** — Any person from a mountainous country. Highland regiments, though assuming the dress of highlanders, are made up of her Majesty's subjects from all parts of her dominions, nevertheless it is stated that 79 per cent. are Scotchmen. The depots of these regiments are permanently kept in Scotland for the purpose of recruiting. There are in the British army nine regiments of highlanders, viz., 42nd, or Black Watch, raised in 1739; 71st, in 1777; 72nd, in the same year; 74th, in 1787; 78th, in 1793; 79th, in 1805; 91st, in 1863; 92nd, in 1796; 93rd, in 1800.

**High-pressure Engine**—A non-condensing engine. (*Vide* Condensing Engine.)

**Hilt**—The handle of a sword.

**Hip Rafters**—The rafters or beams running diagonally from the apices of a pyramidal roof to the corners of the roof.

**History, Military** — A narrative or description of the several military transactions, campaigns, battles, sieges, marches, &c. of armies.

A thorough knowledge of this branch of history is necessary to make the military man apt in his profession, self-reliant, and capable of command. It is indeed the secret of many a commander's success in the varied positions he is placed in in his career, as in the study of military history he finds a precedent for every strategic emergency, and a solution of the many difficult problems in the art of war, which great generals have overcome. The study of military history further tends to create high aspirations after military glory, from the perusal of deeds of valour performed by men who have devoted and sacrificed their lives for the good of their country.

**Hitch**—The name given to certain knots, such as the *timber hitch*, *clove hitch*, and others. These knots are very valuable for artillery and engineer purposes, the advantage being that, as long as the strain is kept upon them, they never give way.

Hitches may be described as overlaying a part of a rope with itself in such a manner that a loop or loops are formed to jam on each other.

**Hobilers**—An inferior kind of cavalry used or raised in the reign of Edward II. They were stationed at Portsmouth and other maritime places, and bound to keep a little nag for the purpose of giving notice of invasion. They wore an aketon or armour of plates, a bascinet, iron gauntlets, a sword, knife, and a lance.

**Hoist**—An apparatus for raising bodies from the ground-floor of a building to a floor above, such as is used in storehouses.

**Hold, To**—To be in military possession of a place.

**Holdalls, Leather**—Bags or cases for carrying implements for the M.L.R. 7-pr. equipment, are "off" and "near;" each has links at the back for hanging it on the saddle.

**Holes, Blasting**—In the demolition of masonry works and rocks, cylindrical holes are bored and charged with powder, gun-cotton, or some other explosive substance. The instrument used in blasting is a *borer* or *jumper*. The dimensions of holes vary, according to the purpose required, and whether powder, gun-cotton, or other substance, is to be used; gunpowder requires a deeper hole than either of the others.

**Holster**—The leather case which holds a cavalry man's pistol. Lancers and non-commissioned officers of cavalry have two holsters attached to the front part of their saddles. Wallets have been introduced in lieu of holsters for the staff and certain regiments in the service.

**Home**—In artillery, the term used to express the position of a shot when the gun is loaded. Thus, "Is the shot well home?" is a common expression amongst artillerymen.

**Homogeneous** — A term applied to various substances to denote that they consist of similar parts, or parts of the same nature and kind; thus, the substance of a solid shot may be said to be homogeneous when the metal is of the same density and texture throughout. In a perfectly homogeneous shot, the centre of figure and the centre of gravity of the mass are coincident.

**Honey-combed**—In ordnance, the term applied to the holes or cavities on the surface of the bore, which are caused from exposure or having been much used. A gun which is much honey-combed should be condemned as unserviceable.

**Honour** — James, in his 'Dictionary,' states that this is a term variously used in military life, and describes it as follows:—"As a quality of the mind it cannot be too much encouraged or too much cultivated among officers of all ranks and descriptions. The possession of it is a guarantee for good conduct, a bond of fidelity, and a certain barrier against military corruption. Most men are excited to deeds of valour and enterprise, who would otherwise remain inactive, or only perform the mere drudgery of service. This species of honour is, in fact, the root of that *esprit de corps* which makes a whole body of officers tenacious of reputation, and solicitous to preserve it unsullied, from the colonel to the lowest drummer-boy."

**Honourable Artillery Company** — A volunteer force, and the oldest military body in England.

**Honours, Funeral**—The respect paid to officers who, at the time of their decease, were on full regimental pay, or employed on the staff, or in the exercise of any military command.

**Honours, Military**—A general term for the external marks of respect paid by troops to royalty and officers of high civil and military rank. (*Vide* Guard of Honour.)

The auxiliary forces pay military honours, and may provide a guard of honour or escort for a member of the royal family, or for the lord-lieutenant of the county; but a report of the circumstance is to be made to the general officer commanding the district by the commanding officer. In no other case will any body of auxiliary forces take part in any public procession or ceremony, or form a guard of honour, without the special authority of the general officer commanding the district.

**Honours of War**—This expression is more immediately applicable to the terms granted to a capitulating enemy when evacuating a fortress. No precise rules can be laid down as to the terms to be granted, as they depend on the disposition of the victorious general. What is considered granting the honours of war under such circumstances is the permission to the besieged garrison to march out under arms, with colours *flying, drums beating*, &c.

In some cases, the conquered force will only be permitted to advance silently to the front of the works, there to ground or pile arms, and then, facing about, to return to their lines as prisoners of war. Occasionally, the capitulation will provide that the garrison shall deposit their arms and warlike stores at some specified spot, and then march to their own territory on parole of not serving during the existing war against the victors or their allies.

**Hoof**—The hard horny substance on the feet of graminivorous animals. The hoof of a horse is the seat of various diseases, to avert which requires constant attention and cleanliness. (*Vide* Thrush, Sandcrack.)

**Hoof Ointment**—An unguent which is applied to horses' hoofs. It is used for brittle feet or sandcracks, and is made of tar and train-oil in equal parts. As parties of cavalry are liable to be detached from the head-quarters of the regiment, and without a veterinary surgeon accompanying them, they should take a small quantity of medicine for the use of the horses.

**Hook**—An iron crooked catch, in very general use, and distinguished by the name of the fastening to which it is attached. There are gun implements termed *hooks*, which are used in carrying shells which have lugs.

**Hook, Boat**—A wooden staff having a metal spike and hook at one end. It is used in pontooning and military bridging.

**Hoop**—A band of wood or metal to confine the staves of a barrel or cask in their proper place. Copper hoops are always attached to powder barrels, and are made of thick sheet copper, 50 oz. and upwards to the square foot.

**Hooping Cartridges**—Under the head of Cartridge, Gun, it is shown that all gun cartridges are, what is termed, *hooped*, and the necessity for doing so. Hooping consists in making rings of worsted or braid, two, three, or even more, round the body of a cartridge, in order that it may retain its shape.

**Hopper** — A receptacle or wooden funnel through which grain passes into a mill. Hoppers are attached to machines which have to be fed by degrees.

**Horizon**—That line which bounds the view, and appears to separate the heavens from the earth. The horizon is distinguished into the *sensible* and the *real*. The sensible horizon is the circular line which limits the view; the real is that which would bound it if it could include the hemisphere.

**Horizon, Artificial**—Is thus defined in Brande and Cox's 'Dictionary':—"The plane of the horizon is a tangent to the curvature of the earth at any place, and is assumed very nearly by the surface of a quiescent liquid, which thus becomes an artificial horizon, from which the altitude, of a heavenly body for instance, may be measured." The usual mode of forming an artificial horizon is by a bath of mercury, placed under a two-sided glazed cover.

**Horizontal**—Parallel to the horizon; perpendicular to the plumb line.

**Hornbeam**—The *Carpinius betulus* of botanists. The wood is white, hard, and heavy, and is used for the cogs of wheels in machinery.

**Horns**—The bracket projections in mortar beds for handspikes to take a purchase.

**Hornwork**—In fortification, a work thrown out beyond the glacis before a bastion, and having one front. Hornworks having more than one front, and placed before ravelins, are called *crowned works*; their long branches or wings are in every case directed so as to be flanked by the fire of some of the main works.

**Hors de combat** (French = out of the fight)—A military phrase, signifying that an individual, or body of men, is so completely disabled in fight as to be unable to maintain the field of battle.

**Horse**—This noble quadruped, the most important to man of all animals, is to be found in nearly all parts of the world. The native country of the horse is uncertain. He is found in his wild state in the Pampas of South America and in the Steppes of Central Asia. In his domesticated state he is used as a beast of burden, and for draught purposes. When properly fed and treated, he performs all that is required of him with alacrity and good will. By nature he is most docile, full of intelligence, and endowed with affectionateness, all which qualities would be more apparent in him if only treated with judgment and kindness, instead of the harsh and brutal treatment to which he is too often subjected.

As a military animal, the horse is invaluable, both for cavalry and artillery purposes. In the British army, horses are purchased for the service under certain conditions. The general regulations state that an annual allowance of £140 is given, per troop, to the regiments of life guards and horse guards for the purchase of troop horses.

Other mounted corps are allowed, for each horse delivered at the head-quarters of the regiment and finally approved, between £26 and £50 for three-year-olds, and between £30 and £36 for four-year-olds; and these prices are dependent on the service for which the horse is required.

The standard of height is fixed by the commander-in-chief. The fitness of horses in point of appearance, strength, and action, is determined by the purchasing officer, and their soundness by an army veterinary surgeon. The final approval of horses rests with the commanding officers in the cavalry of the line and army service corps; with the deputy or assistant adjutants-general of artillery and engineers respectively, in the case of horses sent to Woolwich for the former corps, or to Chatham or Aldershot for the latter; and with the commanding officers of artillery and engineers in Ireland, and at stations abroad.

In India the horse is used for the draught of all light field guns, but not for heavy ordnance; bullocks and elephants form the draught of such. The horses used in that country for military purposes are, to a great extent, born and bred in the country, some from English sires out of country dams, others of a pure country breed; the latter, as colts, are offered for sale to the government stud or remount depot, and such as are selected by the superintendent are reared in the stud. When ready to be draughted into the service, they are, generally, from 15 to 16 hands high. They form excellent horses for either the cavalry or artillery, being strong, hardy, and capable of much endurance. Formerly the government horses were *entire*, but geldings have been found equally efficient, less impetuous, and more docile and tractable. Besides stud horses, government, from time to time, imports largely into the service horses from Australia, which have been found, from their size and strength, to make admirable draught cattle, but do not stand the climate so well as the *stud-bred*, being subject to liver complaint if picketed out during the hot winds; moreover, they have not the speed of the country horse. In the Bombay presidency, Arab horses are very generally used for draught, as well as Gulf Arab horses, but they want height; they are, however, more hardy, docile, and willing than either the *stud-bred* or Australian.

**Horse Artillery**—One of the mounted branches of the British service. On account of its lightness and mobility it acts with cavalry; the gunners are all mounted on horseback and form detachments accompanying each gun.

The formation of this branch dates back to the year 1793, when two troops were raised at Woolwich. Each troop consisted of 4 guns, but in November of the same year 2 more troops were added, and each troop had then 6 guns. Subsequently it was raised to 12 troops. This branch of the service has been further augmented to the extent, at the present day, of 6 brigades, of 5 batteries each, each battery having 6 guns.

The present equipment of the horse artillery is composed of 9-pr. M.L.R. guns. The gun is made of a steel tube with a wrought-iron jacket: calibre, 3 inches; weight, 6 cwt.; length of rifling, 62·3 inches; rifling, three grooves, with a uniform pitch of 1 in 30 calibres; charge, 1·75 lb. The carriages for these guns are made of wrought iron.

**Horse, Bat,** *vide* Bat Horse.

**Horse Guards**—The official residence, up to a recent date, of the commander-in-chief of the British army. It is situated in Parliament Street, London. It contained the offices of all the head-quarter staff of the army; and the buildings are still utilised by some of the officers and clerks of the Head-quarter Army Department, though the commander-in-chief's official residence has been removed *to the War Office.*

James, in his 'Dictionary,' states that the term "Horse Guards" was given to the present building from a guard having been originally mounted there by the horse guards.

**Horse Guards, Regiment of**—Is the third heavy cavalry regiment of the household brigade, and known as the *Oxford Blues*. It was raised in 1661, and took part in Marlborough's campaigns; it also served under Wellington in the Peninsula, and at Waterloo. This regiment, like the two regiments of life guards, wears a steel cuirass, but over a blue coatee, whereas the coatee of the two latter regiments is red.

**Horse Holders**—Certain of the gunners forming the mounted detachment of a horse artillery gun, who, on the gun going into action, do not dismount, but hold or are in charge of the dismounted horses.

**Horse Pits**—Hasty intrenchments; they are made similar in construction to limber pits, but with a berm of 2 feet for horses' heads; they are only made when the other horses, other than the wheelers, cannot be provided with cover along with the limber.

**Horse Power**—By this term, as introduced by Watt, and as explained in Burn, 'On the Steam Engine,' "is meant the mechanical force necessary to lift 33,000 lbs. 1 foot high per minute Engines now, however, calculated at this rate, really exert a greater power than the nominal power; it is, therefore, of importance to be able to calculate the effective or actual horse power of an engine, without reference to its nominal power. This is ascertained by means of the 'indicator,' which gives the effective pressure on the cylinder of the engine; from this is deducted a pound and a half of pressure absorbed in friction, &c.; the velocity of the motion of the friction in feet per minute is calculated by multiplying the number of revolutions of the engine per minute by the length of stroke." These data having been ascertained, the following rule will give the "effective" power of the engine, calculated on Watt's data:—"Multiply the area of the piston in square inches by the effective pressure (found as above), and by the motion of the piston in feet per minute, and divide this by 33,000; the quotient is the actual number of horse power. For each horse power of an engine, it is calculated that 33 cubic feet of steam is expended per minute, or an evaporation of 1 cubic foot per hour. The combustion of 1 lb. of coal is calculated to raise 6 or 8 lbs. of water into steam. Land engines are generally calculated to consume 10 lbs. of fuel per hour for every nominal horse power, or 5 or 6 lbs. for each actual horse power."

**Horseshoes**—Plates of iron attached to the hoofs of horses to protect their feet from injury. Horseshoes are forged from rods of bar-iron of about 1¼ inch in width and ⅜ inch in thickness. The weight of a shoe varies from 12 to 20 oz., and the width and thickness vary with the strength and age of the horse, the purpose for which he is employed, whether for draught, riding, &c. Old nails make very good horseshoes.

**Horsley Powder**—An explosive agent; it is composed of chlorate of potassa and gall-nuts, in proportion, by weight, of three to one; it has been used in charging torpedoes.

Its disruptive action in relation to the best gunpowder, volume for volume, is something like 15 to 1.

**Hose**—A flexible pipe made either of leather, canvas, or india-rubber. It is attached to water engines to convey water to any particular spot. (*Vide* Fire Engine.)

**Hose, Powder**—A hose formed by sewing together the two edges of a tape, ⅜ inch wide, along its whole length, and filling it with gunpowder. It is used in springing mines, and is enclosed in a trough made of two battens of wood, or in a bamboo. (*Vide* Mining.)

**Hospital, Military**—A place of reception for the sick and wounded of an army. It is either a *permanent* or *temporary* establishment.

Of permanent military hospitals in England, that at Netley (*q. v.*) is one of the finest, and organised in every conceivable manner for the health and comfort of the sick and wounded soldier.

Temporary hospitals are any available buildings, under protection, in the vicinity of towns or villages where warlike operations are being carried *on. In the war* between the French and Germans, hospitals were formed in many of the captured French towns; churches, railway stations, and other public buildings being made available.

Hospitals are of different natures, *general*, *field*, and *convalescent*; they are established in positions, selected according to circumstances, by the head of the medical department, with the sanction of the general commanding the army.

*General hospitals* (*q. v.*) have taken the place of regimental hospitals, which are unsuited for large armies, whereas the former offer the following advantages: greater economy of time in carrying out the administrative duties of the hospital, and reduced expenditure.

All cases of an infectious nature are sent to some general hospital, appointed especially for their reception, at some distance in the rear of the army, about the distance fixed upon for the sick in the case of an anticipated general action, viz. one or two days' journey by rail or water.

*Field hospitals* are temporary establishments, formed for the better attendance of the sick and wounded in the immediate vicinity of the field of battle. They receive all cases that require more careful treatment and diet than can be afforded in bell tents or ambulances, without hospital appliances or equipment.

The proportion of field hospitals attached to each division of an army may be, as suggested, from two to three, which provides for 5¾ per cent. of the sick, the general hospital in rear accommodating 4¼ per cent.; altogether 10 per cent. of the division. It is further suggested that no accumulation of sick should ever be allowed in them, and all men whose cases may become serious from time to time should be sent to the nearest general hospital in rear; in fact, all cases that are not likely to recover in a few days should be thus got rid of. In this way they will be prepared for emergencies. This is all the more essential when the force is moving, and particularly before an action. The evils likely to arise from the collection of large numbers of sick in camp will thus be avoided.

*Convalescent hospitals* (*q. v.*), as the term implies, are hospitals for the reception of men well enough to be discharged from the general hospital, but not sufficiently convalescent to be returned to the ranks.

Commanding officers and medical men will well understand, after what has been stated, the evils arising from hospitals crowded with sick and wounded, and that only a certain percentage should occupy houses, huts, or tents provided for such an object. Every care, therefore, should be taken as to the site of general hospitals, and the usual sanitary arrangements attended to as are laid down for camps. The size of these hospitals should be such as to give each patient at least 600 cubic feet of space, in a tropical climate 800 to 1000. As a general rule, it is recommended that accommodation should be provided for 1400 beds for each army corps.

In India, military hospitals are built for the sick of each regiment in every cantonment. On service, they are provided in every camp, tents—when buildings are not available—being erected for the purpose.

**Hospital Ships**—Ships fitted out as hospitals in all expeditions beyond the sea, for the care of the sick and wounded; they have been found invaluable in our foreign expeditions. In China, in 1860, four were fitted out, and ships for this purpose formed part of the expedition to the Gold Coast in 1874. Their use is thus described:—"They serve either as stationary hospitals or, if sick accumulate, can sail home or to the nearest station, discharge, and return to fill again."

**Hospital Wagon,** *vide* Ambulance Wagon.

**Hostage**—A person given up to an enemy as a pledge or security for the performance of certain conditions.

Formerly, on the occasion of a town capitulating, it was usual for the victors and vanquished to give into custody an interchange of officers as a pledge of good faith, that the conditions of the surrender or treaty would be carried out. When the terms had been completed, the hostages were then exchanged. But had any violation or evasion of the terms on either side taken place, the opposite side held the right to put to death or otherwise punish the hostages in its possession. In these days this right would scarcely be exercised.

***Hostility***—Denotes a state of war or enmity between two or more nations. (*Vide* Acts of Hostility.)

**Hot Shot**—Incendiary missiles fired from S.B. guns. These guns having been superseded, to a great extent, by the introduction of rifled ordnance, from which hot shot are not fired, this nature of shot may be pronounced obsolete.

**Hourglass**—A glass vessel filled with sand, and compressed and attenuated at its centre into the shape of the figure 8, whereby the sand can only run through the connecting orifice in a given time. This vessel is contained in a wooden stand. Formerly each regiment was furnished with this hourglass; and even at the present day native regiments in India use it. A common mode of keeping the time by native guards is by means of a metal bowl having a small hole in the bottom of it, which is allowed to swim on the surface of the water, and to fill in the space of an hour. This rough and ready mode of ascertaining time, though not always correct, gives a near approximation to the lapse of an hour. This nature of time-clock was the first instrument used to measure the lapse of time, independently of the sunshine. A similar time-keeper is also kept, but the arrangement is inverted, the bowl being filled with water, and the water allowed to escape into a receptacle in the same space of time, through a hole in the bottom of the bowl. These kinds of clocks are called *clepsydræ*.

**House, Defence of a**—Warfare affords many instances when it has been necessary to defend ordinary dwelling-houses. The most approved method of doing so is as follows:—"The doors, windows, &c. should be blocked up with sandbags, except such as must be left open for communication. The latter should, if possible, be strongly closed with massive doors; loop-holes should be pierced when necessary, and if there are no projecting wings or porches to supply flanking defence, tambours or stockades should be thrown out for that purpose. If it is necessary to afford increased obstacles, a ditch may be dug round the house. Flat-roofed buildings are found sometimes strong enough to bear light artillery; ruined houses, if they have strong walls, can be converted into cavalier batteries by filling them up with rubbish and earth."

**Household Troops**—Consist of the 3 heavy cavalry regiments, viz. the 2 life guards and royal horse guards regiments and the 3 regiments of foot guards. The especial duty of these regiments is to guard the person of the sovereign and the metropolis. (*Vide* Guards.)

**Housing**—The trappings of a horse. A term nearly obsolete.

**Howitzer**—A piece of ordnance for throwing shells. Howitzers are shorter, lighter, and have less metal in them than smooth-bore guns of the same calibre, but are mounted in a similar manner, having the trunnions placed in the axis of the piece instead of under it. Howitzers have, besides, a chamber for the reception of the charge, either cylindrical or gomer shape; the former may be regarded as obsolete, all S.B. howitzers being now cast with chambers in the latter form. The advantage derived from this shaped chamber is the concentration of the charge, whereby the shell fits close into the chamber, and, little or no windage being left, the projectile receives the whole of the explosive force of the powder.

The Dutch, according to General Cotty, appear to have first introduced howitzers, and the French subsequently cast them at Douay in 1749. In appearance, a howitzer is very similar to a gun, having the same rings and mouldings, but being adapted specially for shell firing, its use is differently applied. Lieutenant-Colonel Owen states in his 'Lectures on Artillery':—"Howitzers were originally introduced for the purpose of firing shells at low angles, and have constantly been found most useful both in field and siege operations, during the wars of the last and present centuries. Since the introduction of shell guns their utility has greatly decreased, for the shell gun possesses greater accuracy and range than the howitzer; these qualities being, in the present day, of greater importance than small weight." *Siege* howitzers are denominated according to the size of their bores in inches, *field* howitzers according to the weight of the shell they throw. The ammunition used with howitzers consists of common and shrapnel shell, case shot, and *carcass*. An 8-inch R.M.L. howitzer has been recently introduced into the service. It weighs 46 cwt. and forms the third of the series of ordnance intended for our future siege-train. The length of this piece is 5 feet 1¼ inch from muzzle to button, there being no cascable as in the "Woolwich infant;" length of bore 4 feet. The rifling is on the Woolwich system, having a uniform twist of one turn in sixteen calibres. It has four grooves. (*Vide* Appendix B.)

**Hurdles**—Are constructed in nearly the same manner as gabions, except that the pickets are placed in a straight line instead of a circle. Hurdles are 3 feet high, and 2 feet broad, and are found very useful in fortification, in the construction of a *hurdle revetment*. During sieges they serve as a cover for the protection of the workmen in the trenches, being a speedy means of throwing up earthworks.

**Hurter**—A piece of timber 8 inches square, and about 8 feet long, placed at the head of the platform, next to the interior slope of the parapet. This beam prevents the wheels of the gun carriages from injuring the slope of the parapet, and is also useful for night firing, as marks can be made upon the hurter from observations of the enemy's position taken during the day, by means of which the guns are preserved in nearly the same direction. There is, however, an improved way now of directing the fire of guns by night. (*Vide* Collimator.)

**Hussars**—Light cavalry. The name is derived from the Hungarian words *husz* (twenty), and *ar* (pay), because every twenty houses had to provide one horse-soldier. In the British army there are 13 regiments. The men are armed with a sabre, carbine, and pistol. The weight the horse of a hussar carries is about 18 stone.

**Huts**—Permanent or temporary shelter of an army when not in the immediate vicinity of an enemy, and when no fear exists of having suddenly to break up the camp. They are used in preference to tents, when an army is concentrated and has taken up quarters for the winter or any other lengthened period. Sir G. Wolseley recommends the *Gloucester* and *Sardinian* huts as the easiest and most comfortable, the former holding

24 men, the latter 6. In a tropical climate, where the bamboo is available, huts are easily run up. In the late war on the Gold Coast, huts formed of leaves were commonly erected. In England, standing camps have been composed, for years past, of permanent huts in different parts of the kingdom, such as at Aldershot, Shorncliffe, the Curragh, &c., the huts being chiefly formed of planking. The cubic space given to men in huts should be 400 cubic feet per man.

**Hydraulic Buffer,** *vide* Buffer, Hydraulic.

**Hydraulic Jack,** *vide* Jack, Hydraulic.

**Hydraulic Press**—A machine adapted for giving great pressure in cases where little motion is required. This machine is also called *Bramah's press*, from the name of its inventor. The action of this press is founded upon the fundamental principle in hydrostatics, that, "when a liquid mass is in equilibrium under the action of forces of any kind, every molecule, or part of the mass, sustains an equal pressure in all directions." "An hydraulic press consists essentially of two distinct parts, viz. the *press* or machine, in which the force acquired is applied, and the pumping 'apparatus' by which the water is forced into the press; these two parts of the entire machine being connected only by the pipe through which the water passes from one to the other."

The enormous multiplying power which this machine imparts causes it to be very generally used in all factories where compressing or expressing power is required, also for lifting weights. It is a most valuable machine in gunpowder factories; without it, accurate density could not be given to the powder. Then, again, it is used to give density to metals in their fluid state, a process pursued in the preparation of steel for ordnance and other purposes. The power of the press is easily calculated. Suppose that, the pump has only one-thousandth the area of the cylinder of the press, and that by means of its lever-handle, the piston of the pump is pressed down with a force of 500 lbs., the piston of the cylinder will rise with a force of one thousand times 500 lbs., or more than 200 tons.

**Hydrogen**—A colourless gas, permanently elastic, without taste, and, when perfectly pure, without smell. It can be procured as follows:—"Take a small iron tube, such as an old gun barrel, and partly fill it with iron filings, place it across a fire, so that its middle portion shall be red hot; on sending vapour of water through it from a small boiler, a gas will issue from the other end, which, on the application of a light, will take fire and burn with a pale yellow flame. This is *hydrogen*. In this beautiful experiment, water, which is a compound of hydrogen with oxygen, is decomposed, the oxygen is kept back by the iron, and enters into combination with it, producing oxide of iron. The hydrogen, not having the power of combining with iron, is set free and escapes. Hydrogen is the lightest substance known, hence its use in filling air balloons. Hydrogen has no smell when quite pure, and is not poisonous; it cannot, however, support life. Oxygen is, bulk for bulk, exactly sixteen times heavier than hydrogen; the relative weights, therefore, of any measure of oxygen and two of hydrogen must be as the numbers 16 to 2, or 8 to 1."

**Hydrometer**—An instrument for determining the specific gravities of liquids, and thence also the strengths of spirituous liquors. "It consists of a hollow ball of glass or metal, with a weight below it, and a slender graduated stem above, so adjusted as to float at a particular mark in pure water. When immersed in a lighter liquid, such as spirit, the lateral pressure of the fluid particles which support it being diminished, the bulb sinks, till a portion of the stem becoming immersed, its weight is decreased, and the balance again restored. The instrument may be adjusted to different liquids by movable weights, while the graduations of the scale are made to express the specific gravities by the degree to which its sinks." There are several kinds of hydrometers, but Sykes' is most commonly used.

**Hydro-pneumatic Carriage,** *vide* Carriages, Siege.

**Hydrostatics**—The science "which treats of the mechanical properties of fluids; strictly speaking, the weight and equilibrium of fluids. The weight and equilibrium of fluids at rest are the of this science. When the equi- is destroyed, motion ensues; and nce which considers the laws of motion is hydraulics."

**me,** *vide* Army Hygiene.

**ometer**—An instrument for ascer- the quantity of moisture held atmosphere. "This is effected ving the temperature of the air, dew-point, or temperature at condensation of aqueous vapour kes place. These points being ned, the elasticity and density of ous vapour, its weight in a cubic air, its degree of dryness, and evaporation, may be ascertained bles prepared for the purpose."

**rbola** — In geometry, a curve by a section of a cone, when the plane makes a greater angle with than the side of the cone makes. geometrical description of a *a*, the following is given in 'Conic Sections':—"If two cones be placed apex to apex, and e lines joining the apex and centre in each, in a straight line; then if which does not pass through the made to cut both cones, each of sections will be a hyperbola."

## I.

Congealed water or other fluid. e transport of light artillery ce, the ice should not be less than s in thickness; for heavy artil- to 12 inches or more, the entire of the system being so distributed ch square foot (in contact with ttoms of the runners) shall not nce a pressure of more than about bs. For the passage of small nents of infantry, the ice should less than 3 inches; for cavalry, inches. To strengthen ice, place of straw over it, throwing water t, allowing that to freeze, then layer of *straw and again water.*

The penetration of spherical shot into snow or ice may be taken as follows: the 24-pr. and 18-pr. a mean depth of 15 feet into snow, into ice 8 feet; the 9-pr. 11 feet into snow.

From experiments made in Austria in 1873–74 it was found that the 4-pr. and 8-pr. Austrian rifled guns, with percussion fuzes, penetrated a parapet of snow of 36 feet, tapering off to 12 feet, to a mean depth of 12 feet before bursting. The 8-pr. appears to have produced a remarkable effect; some of the shells, which lodged 4 feet below the superior slope of the parapet, produced a crater 6 feet in external diameter. The conclusion arrived at was that snow defences could not withstand the continued fire of rifled guns.

To test the effects of the Werndl rifle fire, a parapet of the same dimensions as the above was thrown up, but the snow was not rammed so hard. The mean penetration of the bullets was found to be as follows: at 100 paces, 3½ feet; 300 paces, 3 feet; 600 paces, 2½ feet. The conclusion here arrived at was that a snow parapet, 6 feet high, and of the requisite thickness, affords very efficient shelter against infantry fire, even at short ranges, but that, owing to the superior penetration of the projectiles in snow, the protection is not equal to that of an earthen parapet of lesser dimensions.

**Ichnography**—In drawing, the ground plan of any work or building.

**Impact**—The blow with which a body in motion impinges upon another either at rest or in motion, the moment of impact being that when the bodies meet. Of the pressure the two bodies will exert on each other, we neither know the amounts nor the time during which they act; but as Colonel Boxer, in his 'Treatise on Artillery,' remarks:—"The third law of motion will enable us to determine the relation existing between the momenta of the bodies before and after impact; for it follows from this law that whatever momentum is gained by one body during the impact is lost by the other, so that, provided no other impulse has acted upon the bodies at the same time, the sum of the momenta remains unaltered. If, then, a body of small mass impinge with great velocity upon a body of much larger mass at rest, and the two bodies after impact move on together with a velocity which, from the nature of the motion, can readily be measured, the masses of the bodies being ascertained, the whole momentum of the two bodies after impact is known; and this being also the momentum of the smaller body before impact, the velocity with which it struck the larger body is immediately known. Suppose, for instance, that a cannon ball weighing 24 lbs. strikes a block of wood weighing 1976 lbs., from which it will not rebound, so that after the stroke the two may move on together with one common velocity of 24 feet per second, the block of wood being perfectly free to move, then, the momenta before and after impact being the same, if $v$ represent the velocity of the ball before impact—

$$24 \times v = (1976 + 24)\ 24, \text{ or}$$
$$24v = 24 \times 2000$$
$$v = \frac{(24 \times 2000)}{24} = 2000 \text{ feet,}$$

and the velocity with which the ball strikes the block is determined from the measured or computed velocity of 24 feet of the block and ball together after the impact."

**Impetus**—Momentum; violent tendency to any point; strictly, a force proportional to the mass and the square of its velocity conjointly.

**Impregnable**—That which cannot be taken. Any work or fortress which resists the repeated assaults of an enemy is said to be *impregnable.*

**Incendiary Shells**—Comprise carcasses which are fired from S.B. guns, howitzers, and mortars. Experiments were carried on in 1874 at Eastbourne, to produce a carcass suitable for rifled guns, and one was tried with considerable success. Carcasses are used to set fire to buildings, shipping, &c. Martin's incendiary shell was once in the service, but became obsolete in 1869. It contained molten iron, and was intended to destroy wooden ships.

**Inch**—A measure of length, the twelfth part of a foot. An inch is the smallest lineal measure to which a name *is given.* It is, however, divided by *mechanics* into eighths, and by surveyors and others into tenths, hundredths, and thousandths. The inch was formerly divided into three parts called barleycorns, and also into twelve parts called lines, neither of which denominations is now in common use.

**Inclined Plane**—In mechanics, is a plane which makes with the horizontal plane any angle whatever, forming one of the simplest mechanical powers. The inclination of the plane is measured by the angle formed by two lines drawn from the sloping and the horizontal plane, perpendicular to their common intersection. The following is the mathematical formula for it: $P = W \sin a$, when $A$ = angle of plane, and parts parallel to the plane. The pressure on the plane $= W \cos a$.

**Incorporation**—That process in the manufacture of gunpowder by which the ingredients receive the threefold action of *crushing*, *grinding*, and *mixing.* The process of incorporation forms a very important part in the manufacture of gunpowder, and any failure in this stage cannot be made good by any subsequent process. The incorporation of the ingredients is performed by the application of large iron cylindrical rollers, from 5 to 7 feet in diameter, and from 14 to 18 inches in width, each weighing about 4½ tons, revolving in an iron circular flat bed, about 7 feet in diameter, fixed very firmly in the floor of the building, and on which the ingredients (previously mixed) are evenly spread. The *charge*, as it is now called, is moistened with 4 to 6 pints of distilled water, and the rollers are then put into motion by steam or water power; the speed given to the rollers during the time the charge is being incorporated is usually 8 revolutions per minute. At the expiration of the time given to the incorporation varying from 2½ to 4 hours, depending upon the nature of powder, the *mill cake* (the name it now assumes), which is in lumps of ¼ to ½ inch thick, and of a blackish grey colour, is removed to the charge magazine until required to be broken down.

**Increasing Spiral**—A term applied to the twist or the spiral inclination of the grooves of rifled arms, which increases from the breech towards the muzzle; it is also called a *gaining twist* (*q. v.*). The advantages of this kind of rifling are that the projectile, not being forced to take the whole twist of rifling at once, moves more readily from its seat, and thus the initial strain upon the breech of the gun is reduced. Moreover, the studs on the projectile are not so liable to be torn off, or the edges of the grooves to be set up.

**Increment**—The quantity by which anything increases; in mathematics, the finite increase of a variable quantity.

**Incursion**—A sudden raid, with intent to pillage; an entering, an inroad, into a territory with hostile intentions.

**Indemnity**—Compensation for injuries committed by one nation or individual against another.

**Indent**—A form of requisition used when stores are required. The term is chiefly made use of in India, in obtaining stores from the ordnance and commissariat departments. It is equivalent to the meaning of drawing upon any establishment for what is required, either for daily or periodical supplies, or to renew articles in use.

**Indentation**—In S.B. ordnance, the mark caused by the bounding of the shot in the bore. This phenomenon in the bore on the combustion of the charge may be thus explained. The fluids produced by the combustion of the charge and a small quantity of unconsumed powder rush at once between the upper side of the bore and the shot, which, by virtue of its inertia, resists the movement; the current presses it upon the lower side of the bore, and causes an indentation, which increases in depth at each discharge; this cavity is called also a *lodgement;* the lodgement gives rise to a *burr*, formed immediately in front of it by the displaced metal.

**Indian Army**—The army which garrisons our great Indian dependency. It consists of British and native troops.

The Indian army in the days of Clive, which was composed of both British and native troops, was comparatively small, barely sufficient to hold its own; but even in those days it did great deeds of valour, as the battle of Assaye and other battles testify. By degrees, as the East India Company increased its territory, a larger army was found necessary, and both British and native troops were augmented. In 1857 the mutiny of the native army took place, which necessitated a change in the organisation of the army, involving a large increase of the British force. From this date the army of the East India Company became a part of her Majesty's army, paid out of the revenues of India.

The army of India at present consists of 62,850 British troops and 128,500 native troops. More than half the former are stationed in the Bengal Presidency, 38,000 men being in garrison along the valley of the Ganges, Oude, and in the Punjab, while the strength of the native army for the same presidency amounts to 49,000. Bengal proper alone requires about 7000 English troops for its guard, or nearly one-ninth of the total number of the British employed in India. The remainder are distributed amongst the North-West Provinces and in the presidencies of Madras and Bombay. (*Vide* Appendix E.)

**Indicator**—A self-registering instrument attached to a steam-engine to indicate the effective force of the piston.

**Indirect Fire**—In gunnery, the firing at an object which is covered by a parapet, glacis, or wall, so that it cannot be seen from the battery; this is also called *curved fire* (*q. v.*). The value of indirect fire was shown at the siege of Strasburg in 1870, when the Germans used a rifled gun (15-centimetre), shortened, which enabled them to fire with comparatively small charges.

**Inertia**—The total absence of all power in a body to change its state. Matter is no more inclined to rest than to motion, and were it not for external causes, such as the resistance of the air on or near the surface of the earth, a body once put in motion would continue its direction for ever.

**Infantry**—This word is stated in Brande and Cox's 'Dictionary of Science and Literature' to be derived from the Latin *infans*, a boy or servant, as, during the middle ages, servants went on foot, while the knights rode on horseback; hence the word *infanteria* became the name of foot soldiers in general. Another origin of the word is stated, viz. that it is derived from the Spanish soldiery of the infanta or *infanta*, and the term *infanteria* applied to them, in consequence of their being under the infanta of Spain.

Among the ancient Greeks and Romans the infantry constituted the chief strength of an army, and since then, with the exception of those days of chivalry when a fictitious importance was given to cavalry, the infantry has always been considered the main strength of an army. In the English army the infantry is formed into what is commonly called regiments, whether they consist of one or more battalions; they vary in strength according to whether the regiments are on home or on foreign service. The majority of the regiments have only one battalion, but twenty-five have two; one has three; and two, four battalions.

The oldest infantry regiments are the Coldstream Guards (General Monk's regiment), the Grenadier and Scots Fusilier Guards, the 2nd Queen's (raised for the defence of Tangiers), and 3rd Buffs (the old London trainbands). These regiments were formed between 1660 and 1662.

**Initial Velocity**—This term is applied to the velocity of a projectile at the moment it leaves the piece. The formulæ for calculating the initial velocity of projectiles will be found in works treating on ballistics.

**Initiative** — In offensive warfare, to take the *initiative* is the power of compelling your adversary to make his movements dependent on your own, the result of which is to give the invader of a territory great advantage. It is also explained as the success obtained by the invader of a territory, suitable for military movements, and defended only by an army, not by fortifications; not only is the advantage in his first onset, but in subsequent engagements, thus disconcerting and to some extent crippling his adversary, so as to frustrate or deprive him of the power of carrying out offensive measures.

**Inquiry, Court of,** *vide* Court of Inquiry.

**Inspection**—This word, which means careful examination, relates to a wide scope of duties falling under the cognisance of military men in their several *positions*, and includes the inspection of men, cattle, books, ordnance, indeed everything attached to the *personnel* and *matériel* of their command, each branch having its inspecting officer, from the general downwards. Thus a general inspects the troops under him, a commanding officer his regiment, a captain his company. Each department also has its duties of inspection.

**Inspector**—An examining officer; one who inspects.

**Inspectors-General**—Officers appointed by the Horse Guards, with the exception of the Inspector-General of Fortifications, to carry out, in the most searching manner, the duties of inspection in their respective branches, and to bring to the notice of the commander-in-chief all points with which he should be made acquainted. They are assisted in their duties by *inspectors*, who act under their instructions.

**Institution, Royal Artillery** — An establishment organised at Woolwich in the year 1838. The building was erected at government expense, and is supported partly by subscriptions from the officers of the regiment and partly by government. It contains a museum, lecture-room, laboratory, theatre, and printing-press. Reports, *verbatim*, of all lectures which have been delivered are issued periodically to all its members. It is a repository for the sale of military books, stationery, &c.

**Institution, Royal Engineers** — A similar institution to that established by the royal artillery at Woolwich, but of older date (1813), and formed at Chatham. It contains a library of 12,000 volumes, and publishes yearly a volume of professional papers, with the view of conveying, to all members of the institute, the knowledge and experience acquired by each officer of the corps. It publishes besides a small monthly paper, printed at the expense of the institution.

The new buildings which now form the present institute comprise a lecture-room, theatre, and class rooms for both officers and men for the several branches of military engineering, as well as for photography, and for photographic and ordinary printing.

**Institution, Royal United Service** — An institution situated in London, and founded in 1831, under the auspices of William IV. and under the patronage of the Duke of Wellington. It has now become in every respect a useful institution for the advancement of professional knowledge and the higher education of officers of all branches of the service. It contains a collection of large and valuable models, arms, &c., a map and chart room, a professional library of 15,500 volumes, and lecture-room, where papers of vital interest to both army and navy are read and discussed, and subsequently published in a well-known journal, which is appreciated by officers at home and abroad, as well as by the governments of foreign countries. Many of the most interesting subjects that afterwards occupy practical attention find the first germs of their existence in the lectures given in this institution, and at this time of rapid and constant transition, the discussions that take place are acknowledged to be of the greatest utility to both naval and military departments of the government.

The Royal United Service Institution is maintained by subscriptions, and receives a grant as well as a building, rent-free, from the government.

**Instructor, Musketry**—An officer attached to each regiment of the regular and auxiliary forces, to carry out the instruction and practice of the musket. He is one of the permanent staff of a regiment.

**Instructors, Garrison** — Officers of either branch of the service who are appointed to certain districts of the army at home and abroad, to instruct officers of the regular army and of the auxiliary forces in the advanced branches of their profession. Schools are formed to which officers, detached from their regiments, have to attend. In England, there is a *superintendent* of garrison instructors, who resides at Aldershot. In India there is a *director*, with *chief*, *garrison*, and *assistant instructors* under him. The residence of the director of garrison instruction in India is with the head-quarters of the army.

**Instruments** — Tools used in various workshops, with which mechanical work is performed.

**Insubordination**—This term is known in military life under the following phases:—

1. Striking a superior officer;
2. Using or offering violence against a superior officer;
3. Offering violence in a military prison;
4. Disobeying the command of a superior officer;
5. Using threatening language to a superior.

For either of the above offences a soldier is to be tried by a general court-martial.

**Insulation**—When a body containing a quantity of free heat or electricity is surrounded by non-conductors, it is said to be insulated.

**Insulator**—Any non-conducting substance is an insulator; among the best are—

Dry air;
Shell-lac;
Sulphur;
Resins;
Gutta-percha;
Caoutchouc;
Silk;
Glass.

**Intelligence Department**—A branch of the Quartermaster-General's department, presided over by the Deputy Quartermaster-General. It has for its object the collecting, sifting, and arranging of all information on subjects useful to the government or army in peace or war. This department in England is comparatively of recent date. Its functions comprise:—

Topography;
Strategical and tactical questions;
Concentrations;
Military statistics;
Collection of all data bearing on the organisation of foreign armies;
Home and colonial defence, &c.

The information to be obtained on the above subjects is gathered in time of peace, so that, when war breaks out, the general commanding an expedition may have put into his hands, the most detailed information that maps can contain of the country in which operations are to be carried on, and all such other information needful for the vigorous prosecution of the war.

Formerly, whatever information the general obtained, was through the Quartermaster-General's department, then imperfectly organised for obtaining such intelligence as is now afforded, and also by reconnoissances a day or two in advance of the army. Nowadays, a general is made acquainted with the country he has to traverse before he sets out, and is thus often enabled to map out his future movements before commencing operations.

To the intelligence department may be attributed, to a great extent, the success of the German arms during the war of 1870–71. Before starting on the campaign, maps of the country the army was to invade were largely distributed, and also handbooks, containing information on many valuable points, such as railways, localities, power of districts to afford food, &c.—in short, all information tending to the successful issue of the war.

The intelligence department of this country is modelled after that on the continent, but only for defensive purposes; it is composed of staff officers, whose education and intelligence fit them well for the duties they have to perform. The department may be said to be at present merely the nucleus of what will be, it is to be hoped, a still larger one. There is ample field for an increased number of staff officers, and in comparison with the continental departments, the establishment is small. The following extract from a lecture given at the United Service Institution, in February 1875, by Major Brackenbury, R.A., D.A.Q.M.G, an officer of the intelligence department, will put the reader in possession of the information to be acquired, and the work to be performed by the staff officers of such a department, as carried out in Prussia, Austria, and France:—

"1. A thorough military acquaintance with the topography and resources of all lands belonging to the nation and its neighbourhood.

"2. An intimate acquaintance with the armies and military institutions of foreign powers, as well as of the home army and institutions.

"3. A scheme for movement of troops by railway, road, or water, according to probable eventualities. This is based on a study of home and foreign means of communication.

"4. Military history, which is always a mine of information if honestly drawn up *according to official* knowledge.

"5. Selections from the above items of knowledge carefully drawn up and published for the information of the army. This requires frequent use of the printing-press.

"6. In the three countries the staff is charged with the issue of the requisite maps in case of war, and, for this purpose, is in close intimacy with the great map-making establishments represented by our Ordnance Survey, which is a civil branch, though conducted by officers of the royal engineers."

In time of war the duties of this department would be similar to those performed by that section of the general staff in continental armies, with this exception, that in consequence of the paucity of officers employed in this branch of our service, it would have to be supplemented by special staff officers, in connection with the Quartermaster-General's department.

Preparatory to the commencement of hostilities, all information concerning the country in which the operations are to be carried on—collected and collated by the intelligence department in time of peace—will be furnished to the general in command, who will next have to obtain further information through this department as to the enemy's positions, *moral*, &c., by means of outposts, reconnoissances, spies, and emissaries. The names of the enemy's generals, the organisation and the dress of his troops can then be learnt, as the capture of a single prisoner or patrol may show, even by his uniform, buttons, or lace, the presence of a particular corps. Newspapers may furnish information of great value. During the Prusso-Austrian war of 1866, the first authentic information the Prussians received of Benedeck's march from Olmütz to Vienna was derived from Brackenbury's letters.

The information obtained by the means of outposts is of very great importance; and the first step taken by the staff of continental armies, after the declaration of war, is to draw a *cordon* of light cavalry; to this force one or two officers of the intelligence department are attached. One sphere of action is up to the enemy's outposts, whose movements must be watched, and all information concerning them be obtained by means of vedettes, reconnoissances, &c., without driving them in, to do which would require a reconnoissance in force (*q. v.*), a measure of doubtful value, as it often leads to a general engagement.

The officer commanding an outpost is responsible for the amount, as well as for the correctness, of all the information he sends to the officer commanding; he has, therefore, to exercise his discretion as to what intelligence he sends in, and this should be rather too much than too little. In transmitting any knowledge he has acquired, he must adhere as much as possible to the words of the informant; but if the information be of great value, the person from whom it has been obtained, such as a prisoner, deserter, or patrol leader, should be sent in to head-quarters.

The information obtained from prisoners, deserters, and persons from the enemy's side, is always valuable. The first two classes do not as a rule know much, but travellers, and particularly boys, are great sources of information, as they are close observers, and are less likely to be influenced by patriotism, and a small bribe will suffice as remuneration for the news supplied.

The real rank and file of an intelligence department, before and after hostilities have begun, are the regular paid spies. Officers commanding outposts can make use of local spies, but the main body of these men remain attached to the head-quarters, for specific purposes, under an officer specially appointed for that duty, who should possess the following qualifications:—

1. Thorough reticency;
2. Keen knowledge of human nature;
3. Distrust of all unsupported information.

Lack of information is not the difficulty in war time, for the shifting tendency of men's fears is to exaggerate dangers; the number of spies, therefore, may be safely reduced.

There are two classes of spies, as shown above:—

1. *Local spies.*—These are men accidentally employed, and whose business may take them into the enemy's lines. They are to be trusted in gaining intelligence; moreover, their powers of information are *naturally confined to a* small area, and as they are probably well acquainted with that area, and their being on business, they are not so liable to suspicion.

2. *Paid spies.*—These should always be kept apart and in ignorance of each other. They should receive liberal pay, according to the result of their work. In India, the plan formerly adopted in paying native spies was to put a bucketful of gold mohurs before the man, and to allow him to take away as many as his two hands could hold.

Some military writers lay down that all the information obtained by the intelligence department should be published to the army, as experience has shown that, by acting thus, surprises and panics have been guarded against, great fatigue saved, and that the best marches have been made when the men knew the object of the undertaking.

Having collected the required information, the next point will be the transmission of such intelligence. This is performed in three ways:—

1. By the electric telegraph (*q. v.*);
2. By visual signalling (*q. v.*);
3. By mounted orderlies (*q. v.*).

Sometimes the three are combined. The electric telegraph is applicable for long distances, between stationary points and along main lines; between camps at some distance from one another, field telegraphs may be laid down. Visual signalling is useful in broken ground, across obstacles, with ships at sea, and also for moderate distances, where the points are not stationary for any time, such as the outposts. It was found particularly useful in the Looshai expedition on the borders of Assam. For short distances, mounted orderlies can be used, between points constantly moving, as well as for transmission of news in wooded countries. The following have been found good distances to transmit intelligence by the modes indicated:—

Electric telegraph, above 8 miles;
Visual signalling, 1½ to 8 miles;
Orderlies, 1 to 1½ mile.

**Intendance**—In continental armies, an establishment corresponding to our supply branch of the control department.

In the German army it is a small department, and the duties are more restricted and entirely civil. Until 1866, Prussia had no combatant officers attached to the intendance. It has less independent responsibility, and clashes less with the war department, because it only refers to matters beyond general control, and large funds are always placed at its disposal by the military authorities; nearly two-thirds of the army expenditure is paid by it, like the clothing department.

In France, the intendance possesses the direction and control of everything that concerns pay, provisions (*munitions de bouche*), contracts for the same, clothing department, &c. This department is officered exclusively by officers of the army, of no lower rank than that of captain, and whose age does not exceed 35 years; they have to pass an examination before a board of officers. Their functions are purely administrative, and they have no relative rank.

**Interior Economy**—Applied to military affairs, relates to the whole management of a regiment, the responsibility of which lies with the commanding officer, as he is the mover and director of everything pertaining to his command. It includes all duties in which the officers and men are interested, such, in the former case, as their mess, band, funds, &c., and in the latter, to the messes of the non-commissioned officers and soldiers, their amusements, libraries, in fact, everything tending to the good order and welfare of the regiment.

**Interior Slope**—In fortification, is the inclination towards the town, given to the earth forming the rampart or parapet. It is made steep, usually about ¼, to enable the troops to fire over the crest of the parapet without constraint.

**Intern, To**—A term used in a military sense to express the act of giving shelter to troops which have taken refuge on neutral territory. On passing the frontier, the men are disarmed and sent to the different quarters allotted to them, generally in the interior of the country; they are treated on the same footing as the soldiers of the country, and the officers are allowed to keep their arms, horses, and baggage, but have to give their parole that they will not attempt to escape.

Towards the end of the war of 1870–71, *Bourbaki's* army, sorely pressed by the *Germans, took* refuge in Switzerland, to escape being taken prisoners, and was interned there.

**Interval**—In drill, the lateral space between men or corps. The following is given in 'The Artillerist's Manual' as the intervals in line between the different branches of the service:—

"INTERVALS.

"1. Between files when formed in squadron, 6 inches from knee to knee.

"2. Between the guns of a battery in line, full intervals, 19 yards.

"3. Between squadrons in line, the breadth of a division, but never less than 12 yards.

"4. Between cavalry regiments in line, or between cavalry and infantry in line, as for squadrons.

"5. Between battalions in line, 30 paces.

"6. Between batteries in line, or between artillery and other troops, 28¼ yards.

"7. Between cavalry regiments in contiguous columns, as for squadrons.

"8. Between battalions in contiguous columns, 12 or 30 paces, as ordered."

**Intrench, To**—To secure a position or body of men against the attack of an enemy, by digging a ditch or trench. An army may intrench itself either by a *continued* or an *interrupted line;* in the former case, the line may be composed of parts so connected as to leave no uncovered space between them; in the latter, those parts may be isolated from each other, and uncovered intervals left between them.

**Intrenchment**—Any work or obstacle intended to strengthen a post, or increase its defence.

The method followed by the American troops in intrenching themselves after a day's march is thus described by Major (now Colonel) H. A. Smyth, R.A., in 'The Capture of Richmond':—

"As soon as the brigade was halted in its place, without another word, perhaps, than company command, the arms were piled, and the men broke themselves into working parties to intrench. Of each little squad of twelve or fifteen men, a proportion betook themselves to felling trees, a second proportion to arranging them in the line of the intended parapet, a third to carrying them or other wood (especially fence rails where procurable) up to the disposal of the second, and a fourth to throwing up earth to the front of the logs with their picket shovels. These latter work with all their might till out of breath, when other men relieve them at the shovelling, and so on, so that each man gets one or more turns at it before the completion of the work; and in the very light soil of Virginia a constant stream of earth is kept flying into the required place. In this manner I saw a breast-work, perfectly efficient against musketry fire, thrown up along the entire front of a brigade in forty minutes."

**Intrepidity**—As described in James' 'Dictionary,' is "an unqualified contempt of death, and indifference to fortune, as far as it regards personal safety; a fearlessness of heart, and a daring enterprise of mind. According to Rochefoucault, intrepidity, especially with regard to military daring, implies *firmness* of character, great *confidence* of mind, and extraordinary strength of soul. Buoyed up and supported by these qualities (which are sometimes natural and sometimes acquired), men become superior to every emotion of alarm, and are insensible to those perturbations of the heart which the prospect of imminent danger almost always engenders."

**Inundation**—The flooding of a portion of a country with a view to its defence, by rendering it impassable to an enemy. Several fortified places on the continent are so constructed as to be able to inundate the surrounding country, and thus offer additional obstacles to an advancing army. The means by which inundations may be effected are entirely governed by the nature of the surrounding country and the water-courses; no specific rules thereon can be laid down. It is well known that, on the invasion of Holland by Louis XIV., William of Orange inundated the country by breaking down the dykes.

**Invalids**—Are either worn-out or maimed soldiers, or soldiers who from permanent sickness are unable to remain in the army. There are some invalids who from change of climate recover their health; these men join the ranks again. In the British service, *disabled men* are periodically invalided and sent home from India and the colonies. Besides Chelsea Hospital, for the reception of worn-out and disabled men, the corps of commissionaires (*q. v.*) is open to pensioned soldiers; whilst so attached, they can add to their livelihood by giving their services as messengers or watchmen.

**Invasion**—A hostile entrance into the territory of another.

**Invest, To**—To surround a place, so as to prevent all communication with the country.

**Investment of a Fortress**—This act is synonymous with blockading a place. In the investment of a fortress, so as to counteract the preparations for defence on the part of the garrison, "the commander of the forces about to undertake the siege should not only conceal his intentions from his enemy, but endeavour to mislead him altogether with respect to his proposed plan of operations. By threatening other fortresses, or making demonstrations of offensive war in other directions, he may induce the enemy to send troops and supplies to points distant from the fortress he intends to besiege, leaving it comparatively defenceless; he may then suddenly approach it with forces sufficient to enclose it on every side, and, by occupying at the same time all the avenues to it, preclude the possibility of the garrison receiving supplies, or sending notice of their situation to their friends. By moving with secrecy and despatch, they may succeed in surprising any parties sent from the fortress, who may be foraging in the neighbouring country, and may also seize such provisions and stores as the garrison, had it been aware of their approach, would have swept into the place. This operation is called the *investment* of the fortress."

**Iron**—A metal well known in the arts and in commerce, and the most useful of all the metals. It was known from a very early date, and is frequently referred to in the Old Testament Scriptures, though it does not seem to have been extensively made use of until subsequent to the bronze period. It is invaluable, especially at the present day, when ships and guns are being principally built of it. The great supply of iron is derived from its numerous ores, which are abundantly distributed all over the world. It is found in large quantities in our own country, particularly in the coal districts, where it is known as *carbonate of iron;* it contains small portions of manganese and earthy matter. The ores found in Great Britain are always massive, and contain several impurities, which, if not extracted, affect the quality of the iron more or less. These impurities are got rid of, to a certain extent, in the process of calcining and smelting. There are three different states in which iron is produced; *crude* or *cast iron* (*q. v.*), *steel* (*q. v.*), and *malleable* or *wrought iron* (*q. v.*). These three modifications are the results of several and separate operations, although, when each is tested separately, they are found to differ only in the quantity of carbon or charcoal in their composition. Malleable iron is the purest, and has very little carbon in it; steel contains more carbon, and cast iron generally more than steel. Iron is a metal of bluish grey colour, its fracture fibrous, and it is susceptible of being rolled into thin sheets. When iron is subjected to a red heat, it softens and becomes tough, and its property of welding at a white heat gives a facility in working it which no other metal possesses. When heated above the welding-point, it crumbles under the strokes of the hammer.

**Iron Filings**—Small portions or particles of iron rubbed off by the act of filing; they are used in the manufacture of fireworks and for other purposes.

**Irregular Troops**—Troops which, though in the pay of a nation, do not belong to the regular forces. In the British army there are no such troops. In India there are two or three irregular forces, composed of cavalry and infantry, for the protection of native states. The present native cavalry regiments in her Majesty's Indian army were originally raised as irregular troops. They found their own horses, arms, clothing, &c., for which they received a certain monthly sum; but this has been modified of late years, and they are no longer styled irregular cavalry.

**Isinglass**—A white glutinous substance made from the sounds of certain fishes. It is used in the laboratory as one of the ingredients in forming rolled stars for rockets.

**Italian Army**—One of the armies of Europe.

Italy, like most of the continental nations, has adopted the compulsory system in raising her army, similar to France and Germany. The yearly contingent is put down at 100,000 men, 70,000 of which serve in the first category or active army. In this they remain for 3 years (in the cavalry 5 years); 5 in the reserve of the active army, and 4 in the *mobile milizia.* The length of service therefore is altogether 12 years, and the age of joining the colours is 18 years. The men who have not been called to do duty in the active service form the second category, in which they have to serve 5 years in the reserve of the active army and 4 in the militia. They are only assembled for a few months every year.

By the law of the 30th September 1873, Italy is divided into 7 military commands or army corps, five of which have 2 and two 3 military territorial divisions. Each military division consists of from 1 to 6 military districts, giving a total of 16 territorial divisions and 62 military districts. Further, the kingdom is divided into 6 commands of artillery, of 1 or 2 divisions each (total 12) and into 6 commands of engineers of 2 or 3 divisions (total 16).

The land territorial forces comprise the *permanent army* and the *mobile milizia.*

The *permanent army* consists of the staff, the artillery, and engineers, the infantry, the cavalry, a corps of *gendarmerie,* and the civil departments (commissariat, medical, administrative, &c.).

The *mobile milizia* comprises 232 battalions of infantry, 24 companies of rifles, 15 companies of *bersaglieri,* and 40 companies of field and 20 batteries of siege artillery, together with 10 companies of engineers.

By this system, it is computed that Italy can place under arms the following numbers:—

| | |
|---|---|
| Active army .. | 395,951 |
| Reserve .. .. | 148,004 |
| *Mobile milizia* .. | 279,872 |
| | 823,827 men. |

These forces in war time are organised

into 20 divisions forming 10 *corps d'armée*. (*Vide* Appendix C.)

**Italian Field Gun**—A bronze muzzle-loading rifled gun similar to the French gun. There are two sizes, viz. the 8-pr. and 16-pr. Experiments are being made with steel guns after Krupp's system, with the view of introducing them into the service.

**Itinerary** — A rough sketch of the country through which troops have to march, giving the roads, villages, noting the number of inhabitants, houses, whether of stone, brick, or wood, and conveying as much information of the country as can be gathered in a short space of time.

## J.

**Jack,** or **Jaque, of Defence**—A piece of defensive body armour, worn in the fourteenth and fifteenth centuries. Like all defensive armour, it was generally made of mail or plates; sometimes the coat was quilted, and made of leather or canvas.

**Jack, Hydraulic**—A machine for lifting heavy weights by the agency of water pressure. Hydraulic power is universally used where heavy weights have to be lifted. The power is applied either by hand or steam.

In the gun factory at Woolwich, where great weights have to be raised, such as guns in their different stages of manufacture, the hydraulic jack is invaluable.

**Jack, Lifting**—A machine for lifting weights. That termed the *field service* is used for field carriages only. The arm, which may be adjusted within certain limits to any required height, is a lever of the first order, and is applied accordingly. The body of the jack is the support on which it works, and is capable of lifting half a ton. A lifting jack is attached to each sub-division of a battery. A good substitute for a jack are two handspikes placed under the axletree, when, with the aid of two robust gunners, the carriage can be sufficiently raised to take off the wheel. The jack known as *Clerk's* is the *common screw-jack* of the service, in a cast-iron conical box, with metal top and triangular base. This jack is of great power, and used for heavy carriages in lieu of the "tooth and pinion" and "screw-jack." There are other jacks in the service, such as the *rack and pinion*, lifting 3 tons; *Haley's*, which varies in power from 2 to 20 tons; and *Tangye's hydraulic*, capable of lifting from 4 to 20 tons.

**Jack Tree** (*Artocarpus integrifolia*)—A well-known tree in India. It yields an excellent timber, first yellow, fading to brown, hard and brittle, resembling satin; warps, if not properly seasoned. A cubic foot of unseasoned wood weighs 50 lbs. The timber is used in the Bombay arsenals for packing-cases. The fruit of this tree is very much esteemed by the natives in the southern parts of India.

**Jagged Spike**—A particular kind of spike, which is used for spiking a gun that has to be abandoned altogether.

**Jars, Pegu**—Vessels made of pottery, and glazed externally. They are generally of a very large size, and are constantly used in Indian arsenals for holding oil, &c.

**Javelin**—A spear used by the ancients and by most nations before the introduction of fire-arms. There were several sorts of javelins, made chiefly of wood, with a steel point; and there were some which had feathers attached to them, in the same manner as arrows and darts have. The latter were used by the Poles and other nations, but principally by the Moors, who called them *zagais*.

**Jemadar**—A native officer in the Indian army, whose position corresponds with that of subaltern in a company of European infantry. The name is also given to the headman of a native establishment in a factory, and indeed to any man who exercises authority over a number or gang of men.

**Jib**—The overhanging part of a crane, or a triangular frame with a pulley at the end for the chain to pass over, which leads from the crane.

**Jigger Block,** *vide* Tackle.

**Jim Crow**—This is one of the tools used by railway platelayers for bending rails, and forms one of a set of platelayers' tools attached to the royal engineer siege equipment. It is suitable for bending the 24-lb. rails of the trench railway

**Jorawallah** — An Indian term. It means, applied to a grass-cutter (*q. v.*), one man doing the work of two—for double wages.

**Journal** — In machinery, the bearing portion of the shaft, when it is between the points where the power and resistance are applied; it is also a bearing subject to torsion.

**Joust**—A mock and sometimes a real encounter on horseback. In the former case, it was called a tournament or "tilt." The mock joust took place with pointless lances. But in the real and sanguinary jousts, battle-arms were used, and many a knight lost his life in these tilts. The latter were called *joustes à outrance.*

**Joseraunt**, or **Jozerine** —Ancient armour; a jacket strengthened with plate.

**Judge-Advocate-General** — A government functionary, resident in London, who acts as the legal adviser of the crown in matters touching military law; the appointment is most frequently conferred upon a barrister of some standing, who is also a member of the House of Commons; he is sworn of the Privy Council, and his tenure of office lapses with that of the administration which appoints him.

To this officer, the proceedings of all general courts-martial at home are forwarded, before the execution of the sentence, in order that he may examine them to ascertain that they have been legally conducted; it then becomes his duty to submit them to her Majesty for her approval and confirmation, together with his opinion on any point of law, or of procedure, upon which he may think it necessary to remark.

The judge-advocate-general is liable to serve on courts-martial, but his duties are usually performed at home, by some officer to whom he gives his deputation; and abroad, by an officer appointed to officiate by the convening anthority; in both cases the acting functionary is known as the *officiating judge-advocate.*

No general court-martial can proceed without a judge-advocate; there is nothing to prevent the latter being a civilian, but the custom of the service for a long period has confined the office to military men.

The judge-advocate-general of the Indian army is now, as formerly, appointed by the government of India, and he is assisted by officers of the army belonging to his department.

**Judging Distance**, *vide* Distance.

**Jule**—An Indian term for the clothing of any beast of burden.

**Jump of a Gun**—The increased angle of departure at which a projectile leaves a gun, after the gun has been truly levelled at the target or object to be struck. The method usually pursued to ascertain the "jump" of a gun is to place a target at 120 feet from the gun which has been truly levelled, so as to be horizontal. On firing the gun, the position of the hits on the target determines the "jump," as, if above the level on the target, it shows that the projectile has left the piece with a certain amount of elevation; if it had not been so, gravity would have brought the shot below the level on the target. This "jump" is due to the tendency the gun and carriage have to rotate on the trail. As shown in Captain W. H. Noble's paper "On the Calibre of Field Guns":—"Experiment has shown that this 'jump' which the system makes before the projectile leaves the muzzle is much affected by the nature of the rifling. A breech-loading gun in which the shot is forced through the bore, 'jumps' more than a muzzle-loading gun of the same weight and length."

**Jumper**, *vide* Blasting.

**Junk** — Old rope, which, being untwisted, is used sometimes in arsenals in place of oakum, to pack shot and shell with, and in making wads.

**Junk Wads**, *vide* Wads.

**Justice, Military**, *vide* Law, Military.

**Jute**—The fibre of the *Corchorus olitorius* (pot-herb, or Jew's mallow) and of the *Corchorus capsularis*, herbaceous annuals, which in India grow from 5 to 14 feet high. The former derives its name from the leaves having been eaten as a kind of spinach. The stems yield the fibre known in commerce as that from which ropes, bags, &c. are made.

**Jyntee**, or **Jointee** (*Œschynomine Seeban*)—A wood, the charcoal of which has been used in the government powder works at Ishapore, near Calcutta, in the manufacture of gunpowder. It is thus described by the late Colonel Anderson,

**Bengal artillery** :—"The jointee
from seed, and flowers after the
ear; it then increases in size till
mes a small tree; at three or four
old, it makes the best charcoal,
bres being then large and defined,
ell separated; the charcoal is of a
h colour, and is not dense to the
touch. The tree flourishes best
banks of small nullahs or water-
s. Jointee charcoal is not so soft
t of the urhur or dhall stalk, but
nore dry, brittle, and hard. An
e-sized tree of three years' growth
ccupy about 5 square yards, and
e about three maunds of wood,
will yield about 30 lbs. of charcoal,
antity required for two 100-lb. bar-
gunpowder. Therefore 10,000 bar-
ould require about sixty beegahs of
ider constant cultivation, one-third
ut each year. The average specific
r of jointee wood is ·767, and sp. gr.
charcoal produced from it ·275;
yields 25 per cent. of charcoal."
erience has shown that this wood
so good for gunpowder purposes as
ll bush (*q. v.*), and therefore should
used in case of a failure of that

## K.

**awahs** — An Indian term. Large
rs, placed across a camel's back,
ich camp kettles, pots, &c. are
on the march. The panniers are
nough to carry disabled men.
**ptulicon**—A composition of india-
, gutta-percha, and cork, which by
in treatment is formed into floor
In appearance it is exactly like
h, and is susceptible of having
ds of patterns printed on it. It
metimes been used for floor-cloths
der-houses, but is not so durable
her hides.
**at**—An Indian term. The wall of

**Keep**—A kind of strong tower, which was built formerly in the centre of a castle or fort, to which the besieged retreated and made their last efforts of defence. Of this description is the keep of Windsor Castle.

In the present day, in the defence of villages, after determining whether the whole or only a part of the village shall be defended, it is as well to select some central, easily approached, substantial, and commanding buildings to be converted into *keeps* or interior intrenchments. Keeps should not be defended against attacks made with artillery, but they might be useful as rallying-points if not so attacked.

**Keg**—Another term for a small cask or barrel. With heavy field batteries, kegs are used to hold the tar and grease for lubricating the axle-tree arms. They are also used in the storage of this compound.

**Kentledge** — Old cast-iron articles, which have become unserviceable, such as condemned guns, shot and shell, &c.

**Kettle**, *vide* Camp Kettle.

**Kettle-drums** — Large circular basins of metal, rounded at the bottom, the top being covered with vellum or goat skin. They are used in the cavalry, and were formerly also in the artillery.

**Key of Position**—A military position, which may be naturally weak, but by being strengthened can be made a formidable point of defence. This may be called the tactical key. The strategic key has reference to *higher objects* than mere possession of the position and defeat of the enemy; and no battle should be fought without due consideration being given to these higher objects.

**Keystone** — In masonry, the stone in an arch which is equally distant from its springing extremities.

**Khalassie** — An Indian sailor. This race of men come chiefly from the Chittagong district. Besides a sea life, khalassies take service on shore, and form a large portion of the native establishment attached to arsenals in India, bordering on the seaside. During the march of a regiment in that country, they are employed in looking after the camp equipage.

**Kicking Strap** — A strap used in draught to control a violent horse. One or two should be attached to each horse battery. It is fastened to the shafts, and passes over the croup of the horse, thereby preventing him from kicking.

**Kilt**—A dress worn by men living in the Highlands of Scotland and by a few regiments in the British army. It consists of a loose petticoat extending from the waist to the knees.

The kilt appears to have been worn by the British chiefs as early as the beginning of the seventh century; they were made of skin, but striped kilts were common, and it is said that, in all probability, the Scottish kilt was known among the British earlier than is generally supposed, from the inhabitants of North Britain being on intimate terms with their neighbours and likely to have assumed the dress.

**King-post**—The middle post of a roof, the foot resting in the tie-beam, and the head of the post receiving the upper ends of the principals.

**Kink**—A twist or turn in a coil of rope.

**Kit**—A military term, expressing the complement of regimental necessaries which soldiers are obliged to keep in constant repair.

The kits of all mounted men are packed and carried in valises; those of infantry soldiers and gunners of foot artillery are carried in a knapsack.

The name is also given to a composition of rosin, pitch, bees-wax, and tallow in the proportion of 9, 6, 6, 1; when melted together and poured into water, and worked with the hand, it becomes soft and pliable. It was formerly used in setting the old pattern fuze; since the introduction of Boxer's fuze it is not required.

**Kitchen**—A room or place appropriated for cooking purposes. In the field, trenches are dug in which the soldiers' meals are cooked. The width of the trench depends upon the width of the kettle used, and the length upon the number of kettles. The depth, as laid down in the 'Soldier's Pocket-book,' "should be 12 inches at the end from which the wind is blowing, and continue that depth for 4 feet, decreasing then gradually to 3 inches at the opposite end, where a space must be left equal to the breadth of the trench, to serve as a chimney." For a company on war strength, the same book gives two such trenches, *each 10 feet* long.

**Knapsack** (German, *knapp*, tight, close, compact, and *Sack*, a sack)—A square case of canvas or leather, properly prepared, for strapping on an infantry soldier's back, and containing the whole of his regimental necessaries. Knapsacks are also provided for foot artillerymen, and on the march they are carried with the baggage.

Another derivation of the word has been given besides that shown above. *Knap*, in Dutch, means eatable, and *knappen*, to eat: hence knapsack is a sack containing something to eat. It is doubtful, however, whether the above is correct. The author of this derivation appears to have confounded *Schnappsack* (havresack) with the English knapsack. In German, nouns are commonly made up of various words, so that the combination expresses the precise signification. Thus, *Schnappsack* signifies a sack into which a soldier would stuff anything in the way of eatables or drinkables which he might pick up on the march.

**Knight** (German, *Knecht*, or *Knecht*, also Saxon *cniht*, a servant)—A person who on account of some eminent service, civil or military, is singled out from the common class of gentlemen, and is personally invested with that title.

This word is applied when we speak of a knight of a shire; it likewise means a military man, or rather a horseman, knights of this description having been either the king's domestic servants or his life-guards.

Originally, knights were either the king's domestic servants or they attended upon him on horseback in time of war. The institution of *knighthood* is of very ancient date; it was conferred in England during the Saxon heptarchy, and the first knight made by the sovereign with the sword of state was Athelstane, by Alfred the Great.

The sovereign now bestows knighthood by a verbal declaration, accompanied with the simple ceremony of imposition of the sword. The word "Sir" is prefixed to the name of knight.

**Knots**—Ties or fastenings made with cord or rope. The most useful are the *timber-hitch*, *half-hitch*, *clove* or *cascable-hitch*, *gun-sling*, *reef-knot*, *cat's-paw*, *bowline-knot*, *sheep-shank*, *running bowline-knot*.

**Knotting**—A patent varnish used for laying over knots of wood previous to painting, and for staining the wood of iron-pointed levers.

**Kodallie**—An Indian term. A tool used by the natives of India in digging all kinds of earthwork. The face of the tool is shaped like a hoe, and has a short handle nearly parallel to the face. It is used in a kneeling or sitting position.

**Koopah,** or **Dubba**—An Indian term. A round hollow vessel with a narrow neck, to contain liquid substances, chiefly oil. It is made from the buffalo's hide, the hide being cut into small pieces and placed on a mould in layers, until the thickness required is attained. A small hand mallet is used to beat the hide together, which is then treated with lime, salt, and ashes.

**Krankenträger** (German = sick-carriers)—A special corps organised by the German army; its duty is to carry the sick and wounded. The men are mostly taken from the *Landwehr*, but some are students from hospitals and universities. The former are in uniform, and the latter in plain clothes; but all wear the red cross on their arm, and are under the protection of the Geneva Convention. They are men of two years' service, intelligent, of good character, and have received some theoretical instruction in surgery and medicine. The instruction imparted to these men is directed by superior officers, assisted by surgeons. They are taught to give the first care to the wounded; to carry them on stretchers, and to form the stretchers from any improvised material; to transport the wounded to the ambulance wagons; to prepare the wagons for that purpose; and to perform all such duties as shall be required of them during a battle.

**Kriegsspiel** (German = war game)—This game was invented by a Prussian, Councillor Reiswitz, in order to follow with greater facility the campaigns of Napoleon I. His son, an artillery officer, found it, by reproducing the campaigns on a map, an easy method of studying the different movements of troops, and caused the game to be adopted in about 1824 by Feldmarschall von Müffling. The *Kriegsspiel* eventually became familiar with the army, and was finally introduced in the military schools as the best means of studying strategy and tactics.

This game was not only a study, but a favourite pastime, of von Moltke's, Blumenthal's, Prince Frederick Charles', and of other German officers, who took a prominent part during the war of 1870–1871. It is stated that they carefully studied for years, by means of this game, the ground on which they carried out their operations in France.

The *Kriegsspiel* was first introduced in England after the Franco-German war (1870–71), and is now frequently played in all the large garrison towns of this country. A club has been formed at Aldershot for that purpose.

The necessary apparatus for playing the *Kriegsspiel* is composed of maps carefully prepared on a scale of 6 or 8 inches to the mile; of metal blocks, made to scale, as nearly as possible, representing all the different branches of the service, from regiments to skirmishers; and strings of beads, for cavalry reconnoitring. The number of persons taking part in the game consists of the officers commanding the two armies, of a judge or chief umpire, supported generally by two or three umpires. The umpires alone see the ground occupied by the two forces. Instructions are given as to their positions; the time of the year, the length of the days, the state of the roads, &c. are settled beforehand. The losses made on both sides are calculated by means of tables carefully prepared; they form a large volume, and were published, in 1870, by Colonel von Trotha.

Other circumstances, such as troops sheltered by earthworks, artillery firing out of range, are taken into consideration; those that have not been laid down in the rules are decided by a throw of the dice.

Thus the action gradually develops itself as each army advances on the contested ground, till victory is declared for one side or the other.

The principal utility of the game appears to be in the arrangements previous to and during the early conduct of an action. When the troops get to close quarters, the element of chance enters so largely into the game that it destroys, to some extent, the dependence to be placed on the issue of the battle. The game, however, affords great practice in the drawing up of the order of march of columns previous to an action, and the development of the columns of march into formation for attack.

In the hands of men having some military experience, this game becomes a certain means of acquiring and perfecting a science which in time of peace cannot be easily acquired. It raises questions which are strategical problems of great interest.

**Krupp Gun**—A breech-loading rifled gun. It takes its name from the inventor, Mr. Krupp, who possesses at Essen a large factory for the manufacture of steel guns. The Krupp gun is well known throughout the continent of Europe, and indeed elsewhere: it is the gun especially of the German army. The metal of which this gun is made is cast steel, manipulated after a manner, so it is stated, known only to Mr. Krupp. The original guns of his manufacture were made out of ingots of steel, but subsequently all his guns larger than field pieces were, in their construction, what is technically termed, "built up," somewhat on the same principle as our wrought-iron guns, the advantage of which is known to all artillerists. The mode of building up, as described, is by shrinking around a tube successive layers of steel hoops, which are cut out of a solid ingot of crucible steel, and after being punched through the centre, worked out to form rings, in the same manner as tires are made for railway wheels.

The description of the German 8½-inch gun; given in the *Revue militaire à l'Étranger*, shows that this gun, which is 9 tons in weight, is loaded at the breech, and closed by a wedge, in the centre of which is the vent. The gun consists of a tube, around which nine steel hoops are shrunk on. The tube appears to be so manufactured that about the loading-chamber and vent-piece there are no hoops, the gun being cast in that part of such thickness as not to need them. From this portion up to about half the length of the gun the building-up commences, which is performed by surrounding the tube with one layer of *five rings, the* rear one being narrow, the front one broad; this latter forms the trunnion ring. A second layer, formed of one broad hoop, is then shrunk over the first and over the powder chamber. The remainder of the tube, which is at this portion conical, and which includes the muzzle, is strengthened with three narrower hoops, so arranged that they form, on the exterior surface, steps as it were, adjoining the five hoops before alluded to. Where the hoops meet, a ring, half in the tube and half in the hoops, is placed, which prevents the tube breaking away to the rear. This short description will give the reader an idea of the construction of Mr. Krupp's gun. The wedge, or what the French term *fermeture*, is cylindro-prismatic in shape, and is certainly the most simple of all breech-closing apparatus. From its shape it weakens the breech of the gun less than any other wedge. It is strong and durable, and easily worked. The most important parts of the breech are the Broadwell ring and the circular steel plate for preventing the escape of gas. All Krupp's guns are fitted with these gas checks.

The gun described, which represents the system carried out in all Mr. Krupp's guns, is polygrooved and consists of 30 grooves, and has a twist of 1 in 38 calibres. The projectiles provided for this gun are chilled, and the common shells are 2½ calibres long.

The latest field guns introduced into the German service are also of Mr. Krupp's manufacture, breech-loaders, and made of steel, but somewhat modified in construction to his earlier guns. The light or horse artillery gun, as also shown in the *Revue militaire à l'Étranger*, has a calibre of 7·85 centimetres, the same as the old 4-pr. or 8-centimetre gun; whereas the calibre of the heavy piece for field batteries is 8·8 centimetres, which is less than that of the old 6-pr. or 9-centimetre gun (actually 9·15 centimetres). The guns, as stated before, are made of cast steel; the hinder part up to the trunnions is strengthened by a wrought-iron jacket, which is shrunk on. The breech-closing apparatus is Krupp's cylindro-prismatic wedge. Each gun has 24 V-shaped grooves with one turn in 50 calibres.

The carriages for these guns are, to a

great extent, made of steel, the wheels being of wood. The limber boxes are made of sheet iron.

The ammunition is of a peculiar pattern. The shells are double-cased, or have double sides, forming two projectiles encased one within another; the surfaces of each, as shown in the translation in the 'R. A. Institution Papers,' by Captain Wickham, R.A., are in contact, and consist of a number of small quadrangular pyramids alternately salient and re-entering, so as to form lines of least resistance when the shell bursts. The projectiles have two belts of copper (guide rings) let into grooves on the exterior of the shells, in lieu of the lead-coating on O.P. shells.

The weight of the H.A. common shell is 11·2 lbs., the shrapnel shell 12·2 lbs.; that of the F.B. common shell is 15·4 lbs., and the shrapnel shell 17·9 lbs.

The new guns, besides having a larger charge of powder than has hitherto been employed by any nation, carry a long grenade with a very strong explosive mixture, so that, when fired, the shell bursts into two and a half as many fragments as an ordinary shell. The shrapnel, too, contains more bullets than the ordinary shrapnel. The new guns are also provided with steel gun carriages, that is, the trail brackets are of laminated steel plates, and the axle-tree is also of cast steel; their total weight, even in the case of the heavier calibres, is not so great as that of the present 8-centimetre gun. The powder provided for these guns has a great resemblance to pebble powder.

The result of the trials made with the new Krupp field guns for the German artillery is stated to be in every way satisfactory.

The heavy guns manufactured by Krupp, and used for siege, naval, and coast purposes, are of the following calibres and weights:—

| | |
|---|---|
| 13 inches | 42½ tons.<br>46¾ „ |
| 12 „ | 36 „<br>33 „ |
| 11 „ | 27 „<br>25 „ |
| 9 „ | 14½ „ |

The following are the dimensions of a Krupp gun which has of late been tried in Austria along with the new steel-bronze gun (*q. v.*):—

B.L. 8·7-CENTIMETRE CAST-STEEL GUN.

| | | | |
|---|---|---|---|
| Total length of the gun | | | 6 feet 6 inches. |
| Length of the bore | | | 5 „ 11 „ |
| Number of grooves | | inches | 24 |
| Depth of grooves | | inch | 0·48 |
| Pitch of rifling | | | 3° 59′ 10″, or 1 in 45 calibres for driving edge. |
| Weight of the gun | | | 9 cwt. 66 lbs. |
| Preponderance of the breech (with breech closer) | | lbs. | 103·61 |
| Weight of the projectile (filled) | | „ | 13·95 |
| *Proportion of weight of charge to the weight of projectile | | „ | ¼ to 2 |
| Initial velocity | | feet | 1553 |
| Mean range corresponding to an angle of | 1° | yards | 829 |
| | 5° | „ | 2652 |
| | 17½° | „ | 5793 |
| Dangerous zone for infantry (height 6·233 feet) at | yards 829 | „ | 85 |
| | „ 1658 | „ | 32·3 |
| | „ 2487 | „ | 17·5 |

---

* Charges { Service .. .. .. .. .. lbs. 3·307
{ *Curve fire* .. .. .. .. .. „ 0·882

Double-coated common shells, 2½ calibres long, and fitted with four copper guide-rings, were used for direct shell-fire. For direct fire, with blind shells, single-coated shells were employed.

**Kullum** (*Nauclea parviflora*)—A wood used in the Bombay presidency for fuzes. It is a light, soft, close- and even-grained wood, of a light brown colour, not very durable, and will rot when exposed to wet.

**Kunkur**—An Indian term; a limestone deposited from water. It is very common in India, and used in many parts of the country (wherever it can be procured) for metalling roads, and in the preparation of lime. The lime made from it is known under the name of *ghooting*.

**Kyanising**, *vide* Corrosive Sublimate.

## L.

**Laboratory**—A department of an arsenal for the manufacture and examination of ammunition and combustible stores. A laboratory, as explained in the 'Aide-Mémoire,' should be divided off into the following rooms:—

1. A compressing room, for the lead used in the manufacture of bullets, and for the formation of the bullets themselves.
2. A room for heating composition.
3. Cartridge rooms, for gun and small-arm cartridges.
4. Composition rooms, for mixing compositions.
5. Driving rooms, for driving rockets, port-fires, fuzes, &c.
6. Packing rooms, for putting up ammunition.
7. Rooms for the manufacture of friction tubes.
8. A room or rooms for the manufacture of fulminate of mercury and percussion caps.

These rooms can be arranged either in separate buildings or under one roof; if in separate buildings, they should be connected by covered passages; further, they should be apart from any inhabited buildings. The following precautions against accidents should be taken:—To avoid as much as possible the use of iron in the construction of the buildings, fixtures, tables, &c. of the laboratory; to sink the head of iron nails if used, and paste paper or putty over them: better still, a plug of wood. The use of copper screws or nails is a still better arrangement. The floor should be of wood, and where powder is manipulated, covered with leather, and frequently swept. To keep no more than the requisite quantity of gunpowder in the laboratory, and to have the ammunition and finished work taken to the magazine. Powder barrels should be carried in hand barrows made with leather or canvas, and the ammunition in boxes. Everything that is to be moved should be lifted and not dragged or rolled on the floor, except on the chime of the barrel. Rockets, port-fires, &c. should never be driven in a room where there is any powder or composition, except that in use at the time. The laboratory should never be entered at night, unless it be absolutely necessary, and then a closed lantern with a wax light should be used; no smoking or fire should be allowed near the laboratory.

Instructions on the subject of laboratories in artillery charge, were issued in June 1873, directing the following regulations to be observed. The army circular gives the definition, in the following paragraphs, of the term "laboratory," and the mode of carrying on the operations within it, such as the making up of cartridges, filling shells, and examining ammunition.

"1. By the term 'laboratory' is meant the block of buildings (with the passages and ways leading thereto) in which the examination of all ammunition will take place, cartridges be made up, and shells filled. In most works suitable buildings for the purpose have been erected, consisting of a lobby with barrier at the entrance, and filling room for shells or cartridges with hatches or openings for the admission and delivery of powder or filled cartridges and shells. Where no laboratory building exists, a tent will be used.

"2. Laboratory operations will be carried on under the superintendence of an officer, who must satisfy himself that the several men, as detailed in section 3, understand the duties entrusted to them. The presence of an officer will not, however, be necessary at small detached forts or batteries in charge of master gunners where ammunition is made up for the auxiliary artillery.

"3. The party for laboratory operations will be detailed as follows:—

"Two men as magazine-men, to issue the powder in barrels from the magazine, and receive and stow cases or cylinders containing made-up cartridges.

"Four men for conveying the powder barrels and cases with cartridges or filled shell to and from the laboratory. Two men will be sufficient if only one barrel of powder, or less, be required.

"Eight men for the cartridge or shell-filling room, or less, if a small quantity of ammunition is to be made up. These men will be detailed to unhead the barrels, weigh out charges, make up cartridges, or fill shells, as may be required.

"Two men will be required at the entrance or receiving hatch, to pass in empty shells.

"4. The men engaged in the laboratory will exchange their clothing and boots for laboratory clothing and slippers, in the place provided at the entrance, and will on no account repass the barrier, without again changing their clothing.

"5. Previous to being told off, the men must be warned to lay aside any knives, pipes, matches, or combustibles they may have about them. Any infringement of this rule will be dealt with as *disobedience of orders*.

"6. The operations of filling shells and making up cartridges will never be carried on at the same time in the same room or tent.

"7. The greatest attention will be paid to cleanliness in all parts of the laboratory and ways leading thereto; also in the wagons and barrows used for the conveyance of the powder or ammunition to or from the laboratory. Any loose grains of powder, dust, or grit, will at once be swept up.

"8. No barrow, tool, or tackle used outside will be admitted within the barrier at the entrance of the laboratory.

"9. Nothing will be kept inside the barrier of the laboratory but the authorised articles for a laboratory, a proportion of clothing, also a supply of zinc cylinders for cartridges, which must be thoroughly examined previous to admission.

"10. The shells to be filled will be piled on old shot or stone, outside the entrance to the laboratory or hatch, lettered 'For admission of shell,' if there be one. The shells will be thoroughly cleaned and brushed externally before being passed into the laboratory—planks being laid down when the heavier shells are filled, in order to save the floor.

"11. All shells, previous to filling, will be carefully searched internally, and all loose filings or pieces of lacquer removed.

"12. All shells, up to the 9-inch inclusive, can be *up-ended* by hand on the blocks, for examination and filling. Heavier shells require the tackle and strap.

"13. Made-up cartridges or filled shells will on no account be issued by the same door or hatch through which the loose powder or empty shells are passed in.

"14. Powder barrels will be conveyed to the laboratory, and zinc cylinders containing filled cartridges to the magazine or cartridge store, in barrows, in order to keep them free from dirt or grit.

"15. The floor of the chamber in the laboratory appropriated as a filling room will be covered with hides when in use.

"16. Empty powder barrels will be passed out at once, and stored in a clean place; and in the event of a barrel not being emptied, it will be re-headed and returned to the magazine.

"17. Not more than the equivalent to two barrels of powder will be in the laboratory, or in transit between the magazine and laboratory, at the same time.

"18. A copy of these instructions attached to a board will be hung up in the entrance to the laboratory. Copies for this purpose, printed on foolscap, can be obtained on demand."

**Lac**—As explained in Balfour's 'Encyclopædia,' is "a substance obtained from incrustations made by an insect (*Coccus lacca*) on the branches and twigs of many trees in India. The lac is formed by the insect into cells, somewhat resembling a honeycomb, in which the insect is generally found entire, and owing to whose presence stick lac yields by proper treatment a red dye, nearly, if not quite, as bright as that obtained from cochineal, and more permanent. Lac is found encircling the branches of these trees in the form of a tube; the broken branches with incrustations at various distances are called in commerce *stick-lac*, which ought to be semi-transparent. The colouring matter exhibited by grinding stick-lac, and then treating it with water, constitutes *seed-lac*, which, when melted up into masses, is called *lump-lac*. Shell-lac is obtained by further purifying the seed-lac. Lac dye consists of the colouring matter extracted from the stick-lac. It is met with in small squares similar to indigo, and is used as red dye instead of cochineal. Lac dye is largely manufactured in India and exported to England. In Bengal, lac is chiefly produced in the forests of Sylhet and at Burdwan; it is also procurable in the Deccan; but Siam and Pegu afford the largest supplies." Shell-lac is used for the manufacture of sealing-wax, also as varnish; in the latter form it is applied for setting the fulminating charge in gun-caps, and in coating Boxer's fuzes and friction tubes.

**Lacquer**—A varnish for either wood or brass, made with shell-lac and spirits of wine, in the proportion, for wood, of 2 lbs. of lac to the gallon; another recipe is 1 lb. of seed-lac and 1 lb. of white rosin to a gallon of spirits of wine. For brass, the proportions are ½ lb. of pale shell-lac to 1 gallon of spirit. It should be made without heat, simply by agitation for five or six hours. It should then be left until the thicker portions have subsided, when the clear liquor is poured off, or, if not sufficiently clear, it must be filtered through paper; it darkens by exposure to light, so that paper should be pasted round the bottle to exclude it. Or the following recipe may be used:—

| | lbs. | oz. |
|---|---|---|
| Seed-lac .. .. | 5 | 0 |
| Turmeric .. .. | 2 | 8 |
| Spirits, methylated .. | 5 gallons, | |

*which* will answer for brass fuzes or any *other work*.

A lacquer called black-lead lacquer is used for the preservation of the bores of breech-loading ordnance when laid up in store, and is composed as follows:—

| | lbs. | oz. |
|---|---|---|
| Black, lamp, dry .. | 0 | 12 |
| Lead { black, dry .. | 24 | 8 |
| Lead { red, dry .. | 6 | 12 |
| Oil, linseed, raw .. | 9 | 0 |

There is a red lacquer the ingredients of which are:—Rosin, 12 lbs.; Spanish brown, 2 lbs.; plaster of Paris, 1 lb.; turpentine, ½ pint; this is used to coat the interior of certain rifled projectiles to prevent premature explosion from friction of iron against powder, which in shells with rapid rotation is very great.

**Ladders, Escalading**—Frames of wood, similar to the common ladder, consisting of two side pieces, connected by rounds or steps, and sometimes by rope. The length of the ladders should be relative to that of the works or walls to be escaladed. They are sometimes made in two or three parts, so that they may be more conveniently carried.

There are two kinds of escalading ladders; those in lengths provided by government with other engineers' stores, and those of an impromptu kind, made for the occasion. The first description consists of ladders about 12 feet in length, which fit into one another, so that each joint will give an effective length of 10 feet. The second description of ladder is in one length, which is difficult of carriage.

In India, escalading ladders are made of two longitudinal pieces of bamboo, the transverse pieces of wood being let into the bamboo, and bound round it with strong rope. They are of two sizes, 26 feet and 14 feet long.

**Ladders, Fire**—Ladders made of rope or wire, and placed on the roof of thatched barracks at certain distances apart. The object of the ladders is to enable the men, in case of fire, to receive and pass along the roof the pots or buckets of water handed up from the ground, which, with the assistance of water-engines, may materially assist in extinguishing the fire.

**Laid under Metal**—In artillery, implies the depression of the muzzles of ordnance, when standing out exposed to the inclemency of the weather, so as to prevent water lodging inside the bore.

**Lamellar**—Formed of thin plates or scales.

**Laminable**—Metal is said to be laminable if it can be extended by passing it between rollers.

**Laminated Armour**—Consists of thin plates bolted together, so as to form a shield of a certain total thickness; this depends on the number and individual thickness of the plates employed. Armour so formed is stated to offer much less resistance to shot than solid plating.

**Lamp**—A contrivance for giving artificial light by means of any combustible substance, such as gas, oil, wax, &c. Lamps are employed for all purposes, but those used in magazines, mines, and laboratories, require to be made with great care, to insure safety.

There are also lamps used for night signalling (*q. v.*).

**Lampas**—A complaint horses get on the roof of the mouth. It is removed by scarification or cautery.

**Lancaster Gun**—An oval-bored M.L.R. gun. The following is a description of the Lancaster system of rifling:—"If a gun be bored out cylindrically like an ordinary smooth-bored piece, and two grooves afterwards cut, so as to make a quarter of a turn in the whole length of the bore, but with what is termed an 'increasing' or 'gaining twist,' then if the corners of the grooves be chamfered away, the bore will become elliptical in form. The projectile was elongated, but instead of the transverse section being cylindrical, it was elliptical, so as to correspond with that of the bore, and consequently the projectile could only pass through the bore by rotating (¼ of a revolution) round its longer axis. The gun was of course muzzle-loading, and, therefore, had a certain amount of windage; the shells were made of wrought iron, for the tendency to 'jam' in the bore was so great that cast iron would not stand. This tendency to jam is one of the principal objections to this system of rifling, whereby the bursting of the gun and fracture of the shell is caused."

When hostilities broke out between Russia and England in 1854, some of our 8-inch and 68-*pr. cast-iron guns* were oval-bored on Mr. Lancaster's plan, and sent to the Crimea, but they proved a failure, from the jamming of the projectiles in the spiral bore.

**Lance** (Latin, *lancea*)—This offensive weapon, which consists of a wooden shaft with a sharp point attached to it, is of very ancient date. Amongst the Romans and other ancient nations, the lance was used more as a javelin than as a pike, and was not introduced into modern armies as a cavalry weapon until the time of the first Napoleon, who organised several regiments of Polish lancers for the service of the French army. In the middle ages, and during the Crusades, knights were invariably armed with the lance or spear, which was used as a weapon to thrust with, and not, like the javelin, to be thrown at the enemy. It is doubtful whether the lance is as effective a weapon for cavalry as the sword. Its value in pursuit is incontestable, but at close quarters the sabre is a superior and more handy weapon. During the Sutlej campaign, some of the 16th Lancers, in charging the Seikh infantry, are stated to have suffered from wounds on the arm, inflicted at the moment of thrusting the lance, by sword cuts from wounded Seikhs. This would appear to show the necessity of the lance arm being protected by some sort of defensive armour.

The shafts of lances are made either of ash or beech wood, but bamboo has been found very good. The length of a lance is 19 feet 3 inches; weight, 4 lbs. 4 oz.

**Lance Corporal**—A rank above a private in the line. He is distinguished by a stripe on the arm. He performs the duties and possesses the authority, but does not receive the pay, of a corporal.

**Lance Sergeant**—An acting sergeant. This position is given to corporals when additional non-commissioned officers are required to assist the officers of troops and companies in the discharge of their duty; and if they prove themselves efficient, they are promoted as vacancies occur.

**Lancers**—A regiment of cavalry armed with lances. Each lancer is also armed with a sword and pistols.

Four regiments of cavalry were armed as lancers after the peace of 1815, and dressed like the Polish lancers. The 9th, 12th, 16th, and 23rd regiments were selected for this arm. Another regiment has since been added, making, now, five regiments of lancers attached to the British army. This nature of cavalry was much appreciated by the first Napoleon, who placed great reliance on some Polish regiments. The Russian Cossacks are armed with the lance, and are considered the type and perfection of lancers.

**Land Transport**—A branch of the control department. It comprises men of the transport companies, and cattle for the draught or otherwise of the stores and baggage of an army. Carts or wagons of the lightest nature should be used, and the horses employed to draw them should be driven and not ridden. Pack animals should only be used on emergency, when a sufficient number of carts cannot be obtained. In mountainous countries, resort must be had to this kind of transport, as was the case in Abyssinia. But, as a rule, pack animals are to be avoided, as being the worst and most difficult transport to manage. In India, the transport consists of bullock carts of the country, elephants, and camels.

**Lands**—In artillery, the space between the furrows or grooves of a rifled gun.

**Landsturm**—The third reserve of the German army. The German soldier, after remaining 3 years in the active army, 4 in the reserve, and 5 years in the *Landwehr*, is draughted into the *Landsturm*, which owes its origin to the wars of the first empire, and was formerly a force raised for home defence only. But, in 1874, a bill was passed by which the emperor can summon that force of his own authority in case of urgency, and the men of the third reserve can be draughted into the *Landwehr* if their services are needed.

It is computed that this new organisation will increase the strength of the German army up to nearly two millions of men. (*Vide* German Army.)

**Landwehr**—The second reserve of the German army. It was created in May 1813. (*Vide* German Army.)

**Langrage**, or **Langrel**—Case shot made up of pieces of iron of irregular shape and size (now obsolete). It was formerly used for disabling sails and rigging of ships.

**Lansquenets** (German, *Landsknechte*, countrymen, or *Lanzknect*, from the lance or pike which they carried)—German foot soldiers raised towards the end of the fifteenth century. They enlisted voluntarily, and hired themselves out as mercenaries to any power that was willing to pay them. Charles VII. of France first added them to his infantry. After the sixteenth century the name fell into disuse.

**Lantern**—A contrivance for the purpose of giving light; it is made of glass or any transparent matter. There are two kinds of lanterns, *dark* and *Muscovy*, which are used at night in batteries or on the line of march.

**Lanyard**—A thin cord, with a hook attached to one end of it, for pulling the friction bar out of a friction tube, after it is placed in the vent of the gun, by which means the tube is ignited and the flame conveyed to the charge. The hook is placed in the eye of the friction bar, and at the other end there is either a loop or a wooden toggle. There are five sorts of lanyards for firing friction tubes, all of which are described in the 'Treatise on Ammunition, 1874.'

**Lapel**—Facings of a coat.

**Lapping**—The process a gun undergoes after being rifled, also after "proof," for the purpose of removing any little burrs which may be thrown up on the edge of the grooves by the proof rounds.

**Lascars**—Native seamen, originally from the Malay Archipelago. The name is commonly given to the native sailors used in the mercantile marine.

Such men, under the name of *khalassies* (*q. v.*), are employed in some of the Indian arsenals. At Hongkong and in Ceylon there are companies of lascars in the pay of the British government.

**Lashing**—The securing together any bodies by means of ropes; there are two modes generally used, viz. *square* and *diagonal*. The nature of rope depends on the work to be done. In securing sheers, guns, and any articles that require to be fixed, lashing is resorted to. There are three kinds of rope used for lashing—*log* line, *seizing* line, and *Hambro'* line. Lashings used in mounting and dismounting guns are of different dimensions.

**Lasso Harness**—The following description is given of this harness in Griffith's 'Artillerist's Manual':—"Lasso harness consists of a brown leather surcingle and one trace. The surcingle is rather wider than a common girth, and is composed of two pieces (joined together by rings), one of which is placed over the saddle, and the other round the belly of the horse. There are also rings at the end of the surcingle, which is drawn very firmly round the horse, and fastened tight by lapping a white leather thong (fixed at one end of the surcingle) through these rings. There are two descriptions of traces, one being 8 and the other 12 feet long. They have hooks at each end, and, when the lasso harness is made use of by cavalry, &c., to assist draught horses in moving very heavy carriages, or in dragging guns, &c. up steep hills, one of these hooks is fastened to a ring in the surcingle, and the other to the carriage, &c.

"Lasso harness may be advantageously employed with all horses; even those unaccustomed to draught having been found perfectly tractable and efficient the first time they were required to draw by means of the lasso. When two horses are in draught, the traces must be inside, and each rider should keep his horse's croup a little outwards."

**Lasting Cloth**—A material similar to prunella cloth, only thicker, which is used for the clothing of mill-men in powder houses. It has the property of not readily catching fire.

**Lateral**—This term in gunnery is used to express the deviation to one side or the other of the vertical plane passing through the axis of the gun, which a projectile is often observed to take in its course.

**Lateral Communications**—In warfare, "are the communications which should be kept up between the different portions of an army when moving from one common base by different roads towards an enemy, so that, in case of a concentration being required on any particular point, instructions and orders can be readily carried out, and the different portions of the army brought together with rapidity. To prevent any obstruction to communications being kept up, especially when advancing towards *the enemy, the several* roads on which the army marches should not, if possible, be separated by rivers, morasses, or a mountain ridge; rivers would not be so objectionable, as they might be forded or crossed by bridges. Marches of large armies have been conducted on a single road; but this is objectionable, and should be avoided. Several roads tending in the same direction, with easy means of concentration, is the most satisfactory way of moving an army."

**Lathe**—That known as the common foot lathe is described as "a machine for turning metals or wood, by causing the material to revolve on central points, and cut by a tool held by the hand or fixed in a slide rest. There are other lathes, which are self-acting and self-adjusting, which are adapted to plain and circular turning, screw-cutting, and boring. Amongst the self-acting lathes is *Whitworth's patent duplex lathe.* The peculiarity in this lathe consists in the employment of a cutting-tool at the back of the lathe, in addition, and opposite, to the tool in front, but in inverted positions each to the other. The transverse forces are thus balanced, and the work produced is more correct, and accomplished in less time than by the ordinary lathe. A lathe consists of four parts: the frame, head-stocks, which have also the differential pulleys to allow the velocity to be changed; the rest, for the tools; and the corresponding differential pulleys upon the shaft communicating motion."

**Latitude**—In geography, "the latitude of a place is its angular distance from the equator measured on the meridian, and can never exceed 90°. It takes its name according to the situation of the place north or south of the equator; therefore all places lying at the same distance from and on the same side of the equator are said to be under the same parallel of latitude; parallels of latitude are circles parallel to the equator." In astronomy, the latitude of a heavenly body is its distance north or south of the ecliptic.

**Latrines**—Conveniences for soldiers in camps and barracks. Those used in the former are simply trenches dug in the earth, at some convenient distance from the camp. If in a standing camp, and near bushes, or anything which can give cover, a screen is formed on one side of the trench. Twice a day dry earth is thrown into the pits.

**Law, Military**—A code which, formed for the guidance of a particular class of the community—the standing army—exists side by side with the common and statute law of the land; and its tribunals exercise their functions independently of, and yet in harmony with, the ordinary courts of justice, with which they do not, and cannot, interfere.

**Laying a Gun**—In gunnery, pointing a gun so that the projectile shall strike the object aimed at. This is effected by bringing the top of the notch of the hind sight, the apex of the fore sight (whether muzzle or trunnion), and the object in line. In laying a rifled gun, the scales for elevation and deflection must be first adjusted. This being done, No. 1 of the gun's crew, as is shown in the 'Manual of Artillery Exercises,' proceeds to lay the gun. "He places himself in rear of the gun, bringing his eye to a level with the top of the hind sight, and about 6 inches in rear of it, and, when laying guns where it is necessary to stoop, places his feet so that the body is well balanced, steadying himself by leaning on the gun with his arm, and gives the necessary orders for elevating or traversing, until the gun is laid as above; with field guns he himself elevates or depresses.

"With guns fitted with a traversing bar, the final adjustment is given by No. 1 himself.

"In laying a gun, avoid putting the back of the nail on the top of the sight, the hand to cover the eye, holding the tangent scale, or other peculiarity."

In breech-loading and muzzle-loading rifled guns, provision is made in the sighting to meet what is known as the *constant deflection* of such guns caused by rifling. To provide also against deflection by wind or other inaccuracies, such as one wheel being higher than another, a deflection scale is attached to each gun. (*Vide* Deviation.)

Formerly, guns which had no tangent *scale were* elevated by means of the *quarter sights* or quadrant.

**Lead**—A metal of bluish white colour, and lustrous, tarnishing rapidly by contact with the air; specific gravity, when pure, 11·840; fusible at 601° Fahr.; volatilises at a red temperature. Lead is used in preparing solder for brass, making leaden balls, &c., and is made up in *pigs;* it is also prepared in *sheets.*

**Lead, Black,** *vide* Black Lead, and Lacquer.

**Lead Harness** — The furniture or trappings belonging to the centre and leading horses of a team.

**Lead, Rod**—Lead formed into the shape of a rod. In this form it is used in the manufacture of compressed bullets. The squirting machine for forming the lead into rod consists of an hydraulic press, the ram of which is keyed on to a piston, working in a cylinder immediately above it. A charge of melted lead is poured in through the side of the cylinder, near the top of which is a die of the diameter of the rod required. The charging hole being closed, and the lead having been allowed to cool down to a point short of congelation, the water is pumped in below the ram, the piston rises and carries the lead up against the die, which being then the only exit, the lead is squirted out in the form of a rod, at the rate of between 30 and 40 feet per second. The specific gravity of this rod has been found to be 11·334. The following chemical examination of lead for bullets is herewith given, taken from the 'Woolwich Instructions':—

"*Preliminary Arrangements and Precautions.*

"If distilled water cannot be procured, *rain water* may be used instead, provided it remains perfectly bright when mixed with a small quantity of chloride of barium. This should be tried by adding a few drops of the test to some of the water in a test-tube.

"In obtaining a fresh supply of *nitric acid,* its purity must be ascertained in the following manner:—

"Pour 2 measured drachms of the acid into a dish, add about 12 drops of chloride of barium, and then evaporate to dryness over the lamp. When the dish is cool, dissolve the solid residue by adding sufficient water to half fill the dish, and then pour the solution into a beaker. If the liquid is not quite clear, the nitric acid is not sufficiently pure.

"The lead to be examined must be scraped perfectly bright, and then cut into small fragments.

"The dishes and glass vessels, after having been cleaned, must always be rinsed out with distilled or rain water before use.

"The exterior of the dishes and flasks must be carefully dried before they are placed over the lamp; the liquids must never be allowed to boil violently, and a cold liquid must never be poured into a hot vessel.

"*Examination of the Lead.*—Place 200 grains of lead fragments in a conical flask, add 6 drachms of nitric acid and 12 drachms of pure water; place the flask on the gauge over the spirit lamp (using a *small* flame) and heat gently, until the lead has thoroughly dissolved.

"If the solution of the metal is perfectly clear, there is no considerable amount of *antimony* or *tin* in the lead, 0·2 or 0·3 per cent. of these metals would render the liquid quite turbid.

"The liquid is poured into a dish and evaporated to dryness over the lamp. When it is nearly evaporated, the liquid must be continually stirred with a glass rod, otherwise it will spurt violently.

"If the dryness is *green*, *copper* is present. This effect is produced by a very small quantity of that metal. Notice need therefore only be taken of this metal when the liquid, after partial evaporation, possesses a decided blue colour. Iron may also be recognised by its imparting a reddish *brown* colour to the dryness.

"Add about 4 oz. of pure water to the dry substance in the dish, stir and heat gently until the solid has dissolved, then pour the liquid into a beaker glass. If it is perfectly bright, or only faintly turbid, the lead is free from any appreciable amount of *antimony*, *tin*, *arsenic*, and *sulphur*.

"If there is any considerable amount of sediment in the liquid, the latter must be passed through a filter (supported in a funnel on the tripod with a triangle placed across it, and the paper moistened with pure water from the jet before the liquid is poured upon it); the clear solution is collected in one of the large flasks. When it has quite passed through the filter, the flask is removed and an empty beaker substituted.

"*The substance on the filter* is washed by pouring pure water into the filter from the jet, until a few drops of the water (collected in a test-tube as they drip from the funnel) remain quite bright after addition of a drop or two of *sulphuric acid*. Fill a test-tube to about one-sixth with *hydrochloric acid*, add an equal quantity of pure water, heat the mixture for a short time, and then pour it slowly round the sides of the filter, having first placed the funnel in a clean test-tube; if any portion of the substance on the filter is not dissolved, it shows that the lead contains *tin*. Add a drop or two of *chloride of barium* to the acid liquid; if a milkiness is produced, it is due to sulphuric acid, and shows that the lead contains *sulphur*. Place a small piece of litmus paper into the liquid (whether clear or turbid), add ammonia gradually, until the colour of the paper is permanently changed to blue, and then a few drops of *sulphide of ammonium;* warm the mixture in the test-tube or in a dish, and then filter, collecting the clear liquid in a small flask. Add *hydrochloric acid* to the liquid gradually, until a piece of litmus paper, placed in it, is permanently reddened, and heat to boiling. If the substance which separates has an *orange* colour or tint, *antimony* is present (the colour should be deep if the quantity of antimony is at all considerable). Arsenic is indicated by a *yellow* colour, which may be masked by the colour of the antimony, in which case the latter is present in considerable quantity. If the substance separated is white or green, it consists only of the sulphur separated from the sulphide of ammonium, and the absence of arsenic and antimony in the lead is proved. The solution in the flask is mixed with three or four drops of *hydrochloric acid*, and then boiled, sufficient pure water having first been added to fill the flask about two-thirds. If the curdy white substance which is first produced dissolves completely when the liquid boils, the lead is free from any appreciable amount of silver; but if any of the substance remains insoluble. after the boiling has been continued a short time, the presence of that metal is indicated."

**Leader, Rocket**—A piece of quick-match enclosed in paper; it is used in firing a number of rockets simultaneously. The pattern approved of is fitted with nine short pieces of quick-match, at intervals of 3 feet; it is 34 feet in length, and has 5 feet of leader clear at each end.

**Leading Rein**—A rein attached to the near side of the bit of the off horse, and held in the driver's right hand. It consists of a single strap, and enables the driver to keep the off up to the near horse.

**Leaf Sight**—One of the sights of rifled guns. It is attached to the tangent sight, and is called a *sliding leaf-head.* (*Vide* Sights.)

**League**—A measure of length, varying in different countries according to the number of geometrical paces it contains. A league at sea consists of three nautical or geographical miles, or the one-twentieth of a degree, and consequently about 3·45 English miles.

**Leather** — The hide of an animal after undergoing the process of tanning. Hides for the purpose of being manufactured into leather are plentiful in most parts of the world. England itself furnishes vast quantities, and a large number of ox and cow hides are received from Monte Video, Buenos Ayres, Russia, and Northern Germany. The East Indies send chiefly buffalo hides. The principal mart in India, to which hides, both buffalo and cow, are brought for sale, is Calcutta, where they pass into the hands of the English merchant for exportation to Europe, or to the tanner to be manufactured into leather.

The following is the mode of preparing hides as carried out in India, which is somewhat similar to that pursued in England. Hides are generally brought to the tanner in a salted or dry state with the hair on, the removal of which is the first process they have to undergo. They are then steeped in water from *12 to 24 hours*, with the view of softening the hides and extracting the salt; to assist this, they are once or twice worked over on a wooden bench or "beam" with a blunt curved knife to complete the softening; they are then transferred into powerful fulling mills called "shocks," worked by machinery, in which the hides, say 50 or 60 at a time, are pounded or pressed until they become perfectly soft and pliable, as if just taken from the back of the cattle. They are now well washed in two or more fresh waterings, and again straightened or rubbed over on the beam, which prepares them for the liming process. During this process the hides are passed through a paste of lime and water, so that both sides are well covered, and then thrown into a heap for 12 hours or more, after which they are thrown into lime-pits and covered with strong lime water, in which they remain from 2 to 10 days, the time to be regulated according to the nature of the hide itself and the state of the weather. The hides are again spread upon the beam and unhaired by scraping them with a curved knife, until all the hair has been removed. This operation has to be repeated several times, so as to leave no chance of even the root of a hair being left, and also with the view of softening the grain. The inner or flesh side of the hides has now to be examined, and all extraneous matter, such as bits of flesh, &c. removed by a sharp currier's knife. All irregularities in the substance are also to be adjusted by shaving those parts which are too thick. The final process is now arrived at, viz. that of preparing the hides for either tanning or loshing, i.e. converting them into buff leather (*q. v.*).

For tanning, the hides have to pass through a chemical process of softening or graining; this is done in various ways by the application of acids. The process is a delicate one, requiring much care and attention, as, without being thus thoroughly treated, a good leather cannot be produced, and, if slightly overdone, putrefaction at once takes place, and the hides are lost. The hides are now washed in clean water, and passed into the hands of the tanner. The tanning process, or converting the prepared hides or skins, is a tedious one, requiring several months, and in some cases (according to the substance of the hide) even years, to thoroughly impregnate the pores with tannin. Many patents and experiments have been tried in England to facilitate the process of tanning, some of which have also been tried in Calcutta, but on all sides it is generally acknowledged that the slow and most natural process invariably produces the best and most durable leather. Tannin is an astringent solution extracted from various barks and nuts of trees. Those chiefly in use in Bengal are the nuts known in commerce as the "myrabolain," "gambier," and the bark of the babool tree. The first and last of these have to be ground or crushed as fine as possible by powerful machinery made expressly for the purpose. These substances readily yield their tannin, and by soaking in water form a strong astringent solution called "ooze."

The last reference to the hides left them in a state ready for the tan pits, which are usually made of wood. The hides are now steeped in one of these small pits termed "handlers," containing merely spent ooze, or such as have little of the tannin left in them. In this the hides are handled for a few hours, when the ooze is changed for a fresh and somewhat stronger ooze. The process is repeated several times, each time increasing the strength of the ooze, until the pit is thoroughly and evenly coloured. They are then gradually passed to the larger tan pits, in which they are spread out, several hundred "pelts" in a pit, with layers of crushed bark and ready prepared ooze. During the process of thoroughly impregnating the "pelt" with tannin, which, as before mentioned, occupies several months, the hides have to be thrown up, and each time fresh supplies of crushed bark and prepared ooze applied. When the hides are thoroughly tanned, the fibres are of one uniform colour throughout, and they are then in a fit state to be dried out and transferred to the hands of the currier, by whom they are prepared for the various purposes of trade and commerce.

**Leather Cannon**—Introduced by Gustavus Adolphus into the army on account of their mobility. Undeniable evidence, however, of their earlier existence, though of a smaller size, is found in the 'Landeshuter Harnisch-Kammer-Inventarium' of 1562, in which mention is made of a "lange lederne Büchse mit Kugel-Modell." Although Gustavus Adolphus improved and perfected the leather cannon which he introduced into his army in 1626, and used in the siege of Wormditt, yet neither he nor the German Freiherr Melchior v. Wurmbrandt, nor the North British Baron Robert Scot, can be regarded as the inventor. The invention is evidently of much earlier date.

A leather mortar for firing shells, on exhibition in the arsenal at Venice, was, the Venetians assert, made in 1349; it is very likely, however, that its origin is somewhat earlier. One is here reminded of the many substitutes for metal ordnance, especially of the wooden cannon (entirely bound with iron hoops), which are frequently mentioned in the period from 1525 to 1530.

The leather cannon varied from a 1-pr. to a 4-pr. The bore consisted of a copper cylinder, of the thickness of three-fourths of the diameter of the ball used. The length of the cylinder was sixteen calibres; cascable and breech were screwed into the cylinder. The vent, of copper, was screwed into the breech. The entire length of the bore was covered with iron hoops, over which a number of ropes were wound, which, in turn, were covered with several layers of varnish. Over these layers another round of ropes was wound, and over this was spread a layer of cement. This process was repeated until the coat was of the thickness of two calibres; the last coating consisted of tarred leather, which gave the cannon its name. The charge amounted to one-fourth, rarely one-third, of the weight of the ball; the cannon was loaded only with canister. Canister-shot, until that time only used in sieges, was introduced by Gustavus Adolphus into the field service, and consisted mostly of musket bullets, though old pieces of iron were very often used. The shot were put into wooden and tin boxes, linen bags, and sometimes only in rude wicker baskets. The leather cannon, of 90 lbs. weight, with its light carriage, was easily drawn by two men.

This cannon, however, by no means met the high expectations entertained of it. Already in 1631 the Swedes ceased using this nature of gun, because at the battle of Breitenfeld it not only became so overheated that the charges ignited of themselves, but it also gave a very short and unreliable range.

In 1629, a certain Lieutenant Wolf Müller, of Chemnitz, circulated the report that he was in the possession of a secret for the construction of leather cannon which had many and decided advantages over metal ordnance. The elector of Saxony ordered Colonel von Schwalbach to investigate and to report as to its worth. The report of the colonel was found to be favourable, and expressed in these words:—"Owing to their light weight, easy transportation, and saving of powder, as well as the advantages they offer in the field against the enemy, and in mountainous and swampy regions, in which latter places heavy cannon can seldom be used at all, such pieces cannot be too highly regarded," &c. The elector ordered the construction of two leather cannon, for which were given "fifty-seven florins three groschen ready money; seventeen florins three groschen for sixty pounds pewter; fifty-one florins three groschen for two and one-fourth hundredweight refined copper. Of the copper, the coppersmith received two hundredweight, with which he made a tube four and one-half ells long, weighing ninety pounds, and used twelve pounds for muzzle and vent. The waste in melting twice amounted to sixteen pounds, the remainder was left to the smith as pay for his work." The trial with these leather guns could not have been very satisfactory, if we may judge from the following item in a record of weights of the armoury at Dresden, June 14, 1630: "Inventory of the weights of copper and pewter of the *burst leather pieces* in the elector's armoury at Dresden:—Copper, one-half hundredweight twenty-six pounds; pewter, thirty-four pounds."

No mention being made of these guns at a later period, it is taken for granted that this one failure was thought sufficient to cool all enthusiasm for leather cannon.

**Leave of Absence**—The permission granted to an officer to be absent from his regiment or staff appointment. In applying for leave, the War Office form should be used. The general commanding has the power to grant leave within monthly returns. For special duties, the officer who is to perform the work in the interim is to be named in the application for leave.

The application of a medical officer goes first to the principal medical officer in the division or garrison; that of a paymaster to the War Office, accompanied by a certificate from a board that his accounts are satisfactory, cash balance correct, acting paymaster engaged, and declaration made that the real paymaster is answerable for substitute.

The application of an officer proceeding on *sick leave* must be accompanied by a medical certificate. If the officer is not likely to rejoin soon, it is usual for the medical board to ask the general to assemble the board or to get him to apply to the Horse Guards, should the regulations point out this to be the course to be pursued.

In the Indian military service, leave of absence includes three kinds, viz.:—

1. Furlough in or out of India on sick or general leave;
2. General leave on private affairs or on sick certificate in India, or short leave to sea;
3. Privilege leave.

In the rules which govern an officer's *furlough in* or *out of* India, there is no distinction between *sick* and *general leave* with respect to allowances hitherto drawn, both being included under the general term furlough; provision, however, is made for the obtainment of leave under medical certificate without all the restrictions applicable to furlough when taken without it. In the rules under the head of furlough, it is shown that an officer of the Indian army must serve 6 years after his return from England or elsewhere, after taking furlough, before he is entitled to any more leave counting as service; but should the officer in question have accumulated leave, so that after 2 years' absence he has still 1 or 2 years' leave due to him, he will be permitted, 3 years after his return, to proceed again on leave without loss of appointment. Thus, by way of illustration, should an officer have 4 years' leave to his credit, he may take 2, return to India for 3 years, and then take the balance of his leave.

An officer may take sick leave as often as he is directed to do so by a medical board, but all leave in excess of what he is entitled to by the furlough rules will have to be made up again in completing his service for pension. Again, absence on medical certificate for a longer period than 2 years at one time, or departure on such furlough within 3 years of the date of return from a previous furlough of not less than 1 year, will involve forfeiture of appointment. This may, however, be extended to a third year on English pay. An officer of the royal (late Indian) service, such as the artillery, engineers, and new line regiments, and who is on staff employ, may proceed under the rules of 1868 to England for 2 years without loss of appointment, even should it be a 5-year tenure; but the time he is absent will be deducted from the 5 years.

An officer of the British army, and holding a 5-year appointment, if proceeding on leave on medical certificate, can only do so for 6 months, retaining his appointment. To regimental officers of her Majesty's British service, the furlough rules of 1868 are not applicable.

With reference to the next head, viz. leave in India, it is ruled that an officer, if he wishes it, may take all his leave in that country, under the same circumstances as if he went to Europe. Further, an officer may take short leave in India, for 6 months in a year, for 2 successive years, without forfeiture of appointment; but should he take advantage of this for a third year, he will lose his staff appointment.

Then, again, an officer may take 6 months' leave on medical certificate, and have it renewed for another 6 months, should his health require it, limiting the absence to 1 year without forfeiture of appointment, which will not be looked upon as furlough, but will be held to constitute a part of the maximum period of 8 years' leave of absence *to which an* officer of the Indian army is entitled in his entire period of service.

*Short leave* not exceeding 3 months may also be taken to sea on the condition mentioned in the above paragraph, but absence from India for any longer period will be treated as furlough.

*Privilege leave* for 60 and 90 days respectively (depending upon the part of the country an officer is cantoned in), in each year, is granted to all officers in military employ without loss of allowances; should this time be exceeded, it must be converted into general leave, unless sickness has been the cause of detention.

**Ledger**—A debtor and creditor account book in which the entry of stores from the day-book are made. In a regiment, pocket ledgers are kept, in which soldiers' accounts and other information regarding the soldier are recorded.

**Legion**—In the common acceptation of the term, signifies any large body of men, and is applied to a distinct force of horse and foot serving with an army. Such, for instance, was the British Legion which served in America, and the Spanish Legion in Spain. The term legion in antiquity was given to a body of Roman infantry, which usually consisted of 10 cohorts, or 6000 men. This, however, does not appear to have been a fixed number, as at different periods in Roman history the legion varied from 3000 to 6000 men.

**Légion d'Honneur** (Legion of Honour)—A French military and civil order instituted by Napoleon I. as a reward for gallant deeds in the field or services rendered to the state. There are five grades in this order: chevaliers (companions), officers, commanders, grand officers, and grand crosses. In evening dress or uniform, the commanders wear a collar ribbon, the grand officers and grand crosses a broad ribbon under the waistcoat, and just peeping over the edge of it. The grand crosses also wear on the breast a star and a jewel cross pendant.

In mufti, the chevaliers wear a slip or small bow of red ribbon in the button-hole; the four other grades a rosette. The lowest grade in the Legion of Honour carries (in the army) a pension of £10 a year.

**Length of Fuze**—Has reference to the period a fuze is required to burn, the time being determined by the range. Fuzes (time), such as are used with M.L.R. guns, burn a certain number of seconds, viz. 5, 9, and 20 seconds respectively. The use and object of these different fuzes are as follows:—

The 5-second fuze is used with shrapnel shell (G.S. gauge), up to the 80-pr. inclusive. This fuze is very necessary for F.S. shrapnel shell, which must be burst with great accuracy to develop its power. (*Vide* Fuze.)

The 9-second fuze is used with common and shrapnel shell (G.S. gauge), up to 80-pr. inclusive, at long ranges.

The 20-second fuze is used for common shell (G.S. gauge, garrison service), up to the 80-pr. inclusive, at long ranges. It is only used in the F.S. for high-angle firing from the 7-pr. gun. It is not available for shrapnel, as it has no powder channels.

B.L.R. guns use fuzes of the same lengths as above.

The following will be found, as a general rule, nearly correct for getting the length of fuze with muzzle-loading rifled guns.

Divide the number of hundreds of yards in the range by 2, and add 1 up to 1000 yards, 2 up to 2000 yards, and so on, for length of fuze in tenths of inches.

**Length of a Gun**—In S.B. guns, is the distance between the rear of the base ring and face of the muzzle, measured in a line parallel to the axis. The length of B.L.R. guns is measured from behind the breech to the face of the muzzle, the breech screw not being included, and the length of M.L.R. guns from the neck of the cascable to the face of the muzzle. The length of a mortar is the whole distance from face to breech, measured along the axis. The length of guns is sometimes expressed by their calibres, but this, except with S.B. guns, as shown by Major Morgan, R.A., in a lecture on "Breech-loading and Muzzle-loading for Guns," is a very inaccurate method of comparing the lengths of rifled guns. "To say with smooth-bore guns that they were so many calibres long was sufficiently accurate, because the *weight of charge* and shot was always in proportion; but with rifled guns, which not only differ in this respect very greatly from smooth-bore guns, but even among themselves, to speak in this manner is very misleading. A 68-pr. gun has about the same length of bore as the 8-inch rifled gun, and is consequently the same length in calibre; but, as the charge of the latter is double that of the former, the number of expansions with an 8-inch gun is only half of what it is with a 68-pr." The more scientific way, as is shown by Captain Simpson, U.S.N., is to designate the length of bores by the number of expansions of the charge.

**Length of Projectiles**—This, as is shown in Captain Orde Browne's 'Treatise on Ammunition,' "necessarily varies in the different descriptions of projectiles for the same gun, inasmuch as it is to some extent subordinate to the consideration of bringing them all (with certain exceptions) to the same weight, but it has been decided that a length of two calibres at least is necessary for very accurate shooting, and it is desirable for good *vis viva*, or destructive effect on impact, at any but very short ranges, to have the weight great in proportion to the calibre, or in fact to the surface of resistance, and of course this is favoured by an increased length of projectile."

**Lens**—A portion of any medium bounded by two spherical surfaces having a common axis, or by a spherical surface and a plane one.

**Letter Book**—A book containing the entry of all official letters written by the commanding officer, or under his direction, to the public departments, and to individuals, on regimental business. It contains an alphabetical index, and a separate index for the public departments. It need not be preserved beyond three years, after it is completed, care being taken to keep copies of such letters as may be likely to be required for reference.

**Letters, Official,** *vide* Correspondence.

**Levée** (French)—This term originally meant visits of ceremony paid in the morning among persons of rank. It is now understood to mean an assembly at court, on state occasions, of those of her Majesty's subjects who are entitled to the privilege of presenting themselves before the sovereign. The privilege of holding levées is also accorded to her Majesty's representatives at home and abroad, to the field marshal commanding in chief, and other high functionaries.

**Levée en masse** (French)—The general rising of a nation in self-defence to repel invasion, or to answer the intentions of its governing powers.

**Level**—An instrument for determining the difference of height between any two objects or places.

**Level, Spirit**—A glass tube closed at the ends, and nearly, but not quite, filled with water or spirit; it is fixed in a piece of wood or metal, with a flat base to which the tube is perfectly parallel; when placed on a level surface, an air bubble will be in the centre of the tube. Of spirit levels used in connection with instruments for measuring the differences of level, or vertical distances between different stations, are the *Y level*, *Troughton's improved level*, and *Gravatt's level*.

**Lever**—As described by Lardner, is "a straight and solid bar turning on an axis. The *arms* of the lever are those parts of the bar extending on each side of the axis. The axis is called the *fulcrum* or *prop*. Levers are commonly divided into three kinds, according to the position which the fulcrum has in relation to the power and weight. If the fulcrum be between the power and weight, the lever is of the first kind. If the weight be between the fulcrum and power, the lever is of the second kind. If the power be between the fulcrum and weight, the lever is of the third kind. Of whatever kind the lever may be, the conditions of equilibrium of the power and weight will be such that they are inversely as their distances from the fulcrum, this being the general condition of equilibrium for all machines which turn round a fixed axis."

**Lever, Armstrong Gun** — An iron handle which is fitted on the circular portion of the breech-screw end of the gun, and revolves with it. It is kept in its position, endwise, by two split keep-pins, working in grooves, turned on the breech-screw. The object of the lever and tappet arrangement is to gain a powerful momentum in tightening up and releasing the vent-piece from its seat in the gun.

**Lever Hitch**—A knot similar to the drag-rope knot or woolding-stick hitch. It is used for tightening ropes, but instead of turning the woolding-stick round, it is applied on the principle of the lever.

**Lever Sheers**—Consist of a long heavy spar, with one end resting on the ground, and the other supported on two short spars, crossed and securely lashed together. The butt end of the spar is heavily weighted, and is usually sunk a little in the ground, resting against a board or slab of wood, to prevent the earth from yielding to the pressure of the force acting in a direction parallel to the spar, and tending to force the end of it into the ground. A rear guy is also employed, to prevent the short cross spars, or sheers, from falling to the front. The pressure of the spar or lever at the point where the short spars cross prevents them from inclining to the rear.

**Lever Truss Bridge**, *vide* Spar Bridge.

**Levy**—In the military acceptation of the term, the act of raising men for the defence and safety of a country. Colonel Graham, in his 'Art of War,' states that "the *personnel* of an army is levied in conformity with such custom as may prevail in each state, or such laws as the government of the state may seem fit to adopt."

**Lewis**—An ingenious mode of lifting heavy weights. It consists of three pieces of iron, two of them wedge-shaped, and the third straight, which, when placed together with the straight piece in the centre, form a dove-tailed wedge. The wedge is inserted in a hole of similar shape, cut either in stone or in metal. To the end of each of the pieces a ring is attached, through which a horseshoe ring is passed, and to this the rope or chain is fastened.

**Libraries, Garrison**—Consist of a collection of books granted by the state to each garrison of the army, which, in connection with regimental recreation rooms, give soldiers an opportunity, as the Queen's Regulations explain, "of employing their leisure hours in a manner that shall combine amusement with the attainment of knowledge."

A committee is formed quarterly in each garrison, the president being appointed by the adjutant-general, for the audit of accounts and the management of the library.

Garrison libraries are formed, not only for soldiers, but, as is shown in Army Circular 1872, clause 117, for the use of officers under instruction, as libraries of reference; they are established in the principal military stations. The garrison instructor is responsible for the library. The circular alluded to details the rules to be observed in the distribution of the books.

**Lieutenant** (Latin, *locum tenens*, holding a place; French, *lieu tenant*, supplying or holding the place of another)—The rank next below a captain. The senior lieutenant takes the command of a company in the absence or death of the captain.

In the foot guards 24 of the lieutenants have the rank of captain in the army, and are called lieutenants and captains.

**Lieutenant-Colonel**—The rank next below that of colonel in the army. An officer of this grade commands a regiment in his own right, if senior, regimentally, and provided he has been selected for the post, agreeably to the regulations, after purchase in the army was abolished. Upon him devolves the care, responsibility, and discipline of the officers and soldiers under his command. He is permitted to retain the command for 5 years, but after that he has to give it up without he is reappointed. After 5 years' regimental service, a lieutenant-colonel becomes a brevet-colonel, if he has not previously received that rank by brevet, or, as may be the case, in the artillery and engineers, by regimental promotion.

**Lieutenant-General**—The rank next below that of general. In war time, he would command the wing of a *corps d'armée*.

**Life Guards**—The mounted bodyguard of the sovereign. In the British army there are two corps so designated. They never leave the country except on great emergency. These regiments were engaged in the Peninsula, and were present at the battle of Waterloo, where they greatly distinguished themselves. The two regiments of life guards wear a cuirass over a scarlet tunic. Their headpiece is a steel helmet. The remainder of their dress consists of leather breeches, gauntlets, and jack-boots. Their weapons are the sword and carbine.

**Life-saving Apparatus, Boxer's**—An apparatus used, in case of shipwreck, to save lives. It consists of a rope carried by a rocket from the shore to the wrecked vessel. The rocket is fired from a bed, in prolongation of which a pry-pole is fixed, and from the rear end of which spring two legs, one opening to the right and one to the left. A stick is attached to the side of the rocket, and a line runs through a hollow at either end of the stick, and the end of the line is secured by a common overhand knot. The effect of the too sudden jerk, which is given to the line when the rocket is fired, is provided for by washers placed between the knot and the stick. The rocket case is made of Atlas metal, and the interior is protected from the action of the composition in the same way as Hale's rockets. The maximum range of this rocket is about 500 yards.

**Life-time**—As applied to cannon, "is the length of time or the number of rounds a piece of ordnance will stand before it becomes unserviceable. This is estimated in smooth-bore ordnance at from 1000 to 1200 rounds with service charge and one shot. Experience, however, has shown that it is not so much the number of rounds fired which destroys a gun as the high elevation given to it to obtain extensive range. Guns fired horizontally, or at no greater elevation than 5° or 6°, do not experience the great strain which a gun fired at 30° would, and the reason is obvious, as guns fired at a low elevation recoil in proportion to the relative weight and friction of the projectile: whereas, when elevated to 30°, the gun cannot recoil, the force therefore is exerted downwards, and the gun impinges on its support, which is comparatively immovable; thus the force which displaced the gun in the first instance is now exerted on the sides of the gun. The initial velocity is also increased with the angle of projection, which causes the shot to press more upon the charge and thus to increase the resistance of the expansion of the gases. This increased resistance also adds to the strain upon the gun." Sufficient experience has not yet been had of rifled guns to state what number of rounds the different classes of such ordnance can bear, but it may be inferred that their endurance will be considerable.

**Light-balls, Ground**—Combustibles fired from mortars at night, to discover the operations of an enemy; they might, failing carcasses, be used in their place. They continue alight from 9 to 16 minutes, according to the calibre. Light-balls are of four different natures, viz. 10-inch, 8-inch, 5½-inch, and 4⅖-inch. Their form is oblong, and about 1½ calibre. The skeleton frame is made of wrought iron, and is partially covered with canvas, and filled with composition which burns with a brilliant light.

The proportion of composition is as follows:—

| | lbs. | oz. | drs. |
|---|---|---|---|
| Saltpetre, ground .. | 6 | 4 | 0 |
| Sulphur, ground .. | 2 | 8 | 0 |
| Rosin, pounded .. .. | 1 | 14 | 0 |
| Linseed oil, boiled .. | 0 | 7 | 8 |

**Light, Bengal**, *vide* Bengal Light.

**Light, Blue**, *vide* Blue Lights.

**Light Cavalry**—Regiments of mounted soldiers who, from their light equipment and active horses, are especially adapted for making long marches, performing outpost duties, skirmishing, &c.

The experience of the wars of 1866 and 1870–71 has shown, clearly and convincingly, that the splendid charges, which in the days of Frederick and Napoleon frequently decided the fate of battles, have passed away, and that, in the future, it is before an action that the main *rôle* of the cavalry will be found to lie. Since the introduction of arms of precision, the duties of this branch may well be considered purely strategical, as cavalry can seldom be employed to take a decisive part in a battle. Upon this branch now devolves the task of preparing the way for an engagement, by *reconnoitring* the positions of the enemy, and giving, as to his movements, as much valuable information as possible. Light cavalry can therefore be used as a screen to mask the movements *of the advancing* or *retreating army, and, like a* swarm of spies, to search the country of the enemy, gather information from all quarters, facilitate and often render unnecessary an armed attack, and, finally, bewilder, by harassing, the foe. Employed as *éclaireurs* or feelers in every direction, they make a ring of mystery round their own army. The enemy does not know their whereabouts, while they carry back valuable information to their chiefs.

The duties now thrown upon the light cavalry soldier demand much increased intelligence, and not only intelligence, but a knowledge of the operations of war. The value of good information is so important, and the evil of bad so great, that it would never be safe to trust any body of ordinarily trained men to fulfil these duties. Light cavalry form an important branch of the intelligence department, and it may be well said that "they are the eyes and ears of an army."

The hussar regiments form the light cavalry of the British army; but the lancers and dragoons, although classed as medium cavalry, are often employed in the same duties. (*Vide* Cavalry.)

**Light, Coast-guard**—A light used for signals, and which burns about five minutes. It has superseded the coast-guard portfire, and its composition consists of saltpetre, 7 lbs.; sulphur, 1 lb. 12 oz.; red orpiment, 8 oz. The top of the composition is primed with mealed powder, and the flash blows off the cap. It is ignited by placing a G.S. primer in the hole in the head of the apparatus, and a sharp blow with a pin projecting from it sets the light on fire. The primer is made on a similar plan to the friction tube; the pin is roughed and coated with friction tube composition.

**Light, Electric**, *vide* Electric Light.

**Light Infantry**—Formerly a body of active and strong men selected from the aggregate of regiments in the service, and made up of promising recruits. They are now, as far as any distinctive characteristic in uniform is concerned, abolished; but the light infantry regiments, still borne on the 'Army List,' and whose appellation is purely honorary, can be distinguished by their equipment; they bear the bugle on the forage cap and knapsack.

Light infantry were originally formed by the first Napoleon, after the Revolution. They were conscripts indifferently drilled, but were necessary to oppose the vast armies that assailed France. Though not so well trained as the regular soldiers of the line, they were formidable by their numbers when acting as skirmishers. It was soon found, as is related by Colonel Hamley, that "these lines of skirmishers—'clouds of skirmishers,' as writers are fond of calling them, not without reason—might be made eminently useful to cover formations, to deceive the enemy, and to conceal tactical enterprises. . . . Now, however, light infantry were rendered capable of opposing disciplined battalions, and further training enabled them also to take their places in the line of battle."

As stated above, there are still certain regiments designated light infantry; and like every other regiment in the service, they are practised in light infantry drill.

**Light, Long G.S.**—This light is used for signalling and illuminating. It burns about five minutes, and is ignited by a G.S. primer, in the same way as the coast-guard light. The old long light was lit by a cap.

**Light, Magnesium**—This light is used for signalling or illuminating. It burns one minute, with a very brilliant white flame, and is composed of saltpetre, 14 lbs.; sulphur, 3½ lbs.; red orpiment, 1 lb.; magnesium, containing 25 per cent. of paraffine, ½ lb. It is ignited in the same way as the coast-guard light.

**Light, Parachute,** *vide* Parachute Light.

**Lightning Conductor,** *vide* Conductors, Lightning.

**Lignum Vitæ**—A wood which grows in the West Indies and South America. It is very hard and heavy, indeed one of the heaviest of woods. It is much used in machinery, and for a variety of work requiring hardness and strength. This wood contains a large quantity of gum guaiacum.

**Limb**—The graduated arc of a surveying instrument.

**Limber**—A carriage mounted on two wheels of the same height as the gun *carriage,* and to which the gun is *attached* when limbered up. It has shafts to which the horses are harnessed. A *light field limber* consists of a framework of wood, which is composed of three futchels, an iron axle-tree, axle-tree bed, foot and platform boards, shafts, and a splinter bar. This is known as the O.P. limber, but the limber of a later construction, made for the 9-pr. and 16-pr. M.L.R. guns, has a wrought-iron instead of a wooden axle-tree bed, and no block between the latter and the limber-hook. There are several other alterations, chiefly in iron being substituted for wood, which are to be found in the 'Treatise on Field Carriages, 1874.' Three ammunition boxes are placed on the framing over the axle-tree bed, "near," "aft," and "centre;" on each of the two former a gunner sits, having an iron guard on the side next to the wheel to prevent accident. At the back of the limber is an iron hook or pintle, termed a limber-hook, to which the trail of the gun carriage is attached, forming for the purpose of transport or manœuvring a four-wheeled carriage. The limber-hook is stated to have been invented by an Englishman in 1804.

**Limber Pits**—Artificial cover provided in warfare for the limbers of guns; size 12 feet long, 5½ feet wide at bottom, 7 feet at top, 3 feet deep; ramps at each end may be made. A pit of this size can be executed in 2 hours by 8 men. Each pit should cover a limber and two horses.

**Limber Up**—An order, given to the gun detachment of a battery after firing, to attach the gun to the limber, preparatory to advancing or retreating.

**Lime, or Oxide of Calcium (CaO)**—This very useful substance is described as being prepared by the decomposition of carbonate of lime by heat. The operation is carried out on a very large scale in kilns or furnaces. Anhydrous lime, or "quicklime," is a soft white, amorphous solid. When exposed to air, it soon absorbs water, the lumps crumbling to a bulky powder, which is hydrate of lime, or "slaked lime." Lime is one of the most infusible bodies which we possess; it resists the highest heat of our furnaces. The uses to which quicklime and slaked lime are put will be found on reference to Abel and Bloxam's 'Handbook of Chemistry.' Lime is occasionally found in saltpetre. It can be detected by oxalate of ammonia.

**Limit, Founder's**—In the manufacture of ordnance, the limitation of error for guns, shot, &c. allowed to the founder.

**Linch Pin**—A steel pin running through an eye at the end of the axletree arm of artillery carriages to prevent the wheel coming off. The metal of which the pin is made is mild steel.

**Line**—In military affairs, a term given to the regular and numbered troops to distinguish them from the guards and the auxiliary troops of the British army.

The term *in line* is applied to a battalion when its companies are deployed on the same alignment to their full extent, i. e. in two ranks. Columns are said to be *in line* when their fronts are on the same alignment.

**Line, Cotton**—Cordage used for tent ropes and slow-match.

**Line, Hambro'**—A small description of cordage; it is composed of four slightly twisted yarns of coarse hemp, twisted together, forming three strands which are twisted together. This kind of cordage is made in skeins, and is used in the artillery service for the same purpose as log line.

**Line, Log**—Cordage used for lashing to gun aprons, sponge and muzzle caps, &c. There is also a log line made in India which is used for choking rockets; for handles for case shot, &c.

**Line, Seizing**—Cordage used on the march for lashing any spare articles: it should be well rubbed with tar and grease, as it is much exposed to the weather. It is made up in skeins about 29 feet long and is 1 inch in circumference.

**Line of Battle**—The formation of an army for battle. In all actions it is necessary to place troops in such a formation previous to making the assault, or in showing front to the adversary, as shall expose them as little as possible, and yet place them in the readiest mode to carry out the orders of the commander. It has been the custom from a very ancient date, coming to us from the Romans, and an accepted principle by most nations, that an army, when drawn up for battle, should be formed *in three distinct* lines: *the first line, to commence* the battle; the *second*, to support it, and to fill up the gaps; the *third*, which is in rear of all, as a reserve.

This triple formation, though modified, remains much the same at the present day; but instead of deployed lines or lines of heavy columns, the troops are placed in lines of half-column formation. This has been rendered necessary from the withering fire and long range of the present arms of precision, which necessitate the reduction of the front of battalions. It has also become necessary, whether taking the offensive or standing on the defensive, that shelter, either artificial (such as shelter trenches) or natural, should be taken advantage of to screen the men as much as possible, and so not to expose them (in the case of an attacking party) more than can be helped before the moment of formation previous to the final rush in upon the enemy's position. (*Vide* Tactics.)

**Line of Fire**—In gunnery, is the production of the axis of the gun directed upon a point which is at a vertical distance above the object to be struck, corresponding to the time of flight required for the range, and at the end of which time the shot will be brought to the object by the force of gravity.

**Line of Least Resistance**—In blasting or mining, is a line drawn from the centre of the charge perpendicular to the surface of the ground.

**Line of Metal**—In gunnery, the visual line connecting the front and back sight when the latter is at its lowest point, i. e. connecting the notch on the tangent sight with the notch on the swell of the muzzle, or dispart sight, when the trunnions are perfectly horizontal.

**Line of Metal Elevation**—In gunnery, is the elevation due to the conical form of the gun, when the gun is laid on an object by means of the sights without giving any elevation. From the thickness of metal at the breech, the line of metal elevation varies from one to two degrees or more.

**Line of Sight**—In gunnery, is the line passing through the notch of the tangent scale and tip of the trunnion sight (at any elevation) and the object.

**Lines**—A connected series of fieldworks, whether continuous or at intervals.

**Lines of Defence**—In fortification, the distance between the flanking and the extreme limit of the flanked portion of a parapet.

In warfare, *lines of defence* are *natural* and *artificial.*

Of the first are deserts, mountain-ranges, great rivers, and dense forests. In general, the frontier line which divides one country from another is formed by some one of the above-named obstacles (*q. v.*), or a combination of them. That which presents the greatest difficulty to an invading army is a desert, which will be understood by all military men.

**Lines of Operation**—With reference to the movements of an army, are "the lines by which it advances from its base into the theatre of war. The advance may happen to be by one road only, but it more often embraces every road by which the fractions of the army march. A large force may thus include a considerable breadth of country in the march of its columns. When all the marching fractions are in communication with each other, the army's line of march is called a *single line of operations*" (*Vide* Lateral Communications.)

**Lining**—In artillery, is the process pursued, after the proving of rifled guns, to enable the manufacturer to adjust the sights and elevating plates.

**Link**—The connecting part of a chain. To measure the length of links, the inside dimensions are taken, as they alone contribute to the length of a chain.

**Linked Regiments**—In localising the forces of the British army, it is laid down that in each of the sub-districts of the country two regiments shall be permanently selected (whether absent or present) to be so localised, and the mode of selection is of regiments having any connection with the county. These regiments are termed *linked*, and in the case of one of the regiments going or being on foreign service requiring men to make up its numbers, soldiers are drafted from the regiment remaining at home.

**Linseed**—The seed of the flax plant. In India, it is principally used in the manufacture of linseed oil; the oil is contained in the kernel of the seeds (*Linum usitatissimum*), and may be either cold *drawn, or, as is* usual, obtained after the seeds have been subjected to a heat of 200°. It is one of the cheapest fixed oils, and is used in the manufacture of paints, varnishes, and printing inks; it is what is termed a drying oil. When required, linseed oil, if fresh, is made use of in its unboiled state, and it will be found superior to any other oil. When quite fresh, it answers very well in making paints, but if not, it requires to be boiled before being used; a quantity of litharge, pounded and wrapped in a piece of muslin, being boiled in it as a dryer.

**Linstock**—Used, when necessary, to hold the slow-match in a standing battery. It is made of wood, the lower end pointed and shod with iron, the upper end, for holding the slow-match, being also made of iron.

**Lip-strap**—A small strap with a buckle passing from one cheek of the bit through a ring in the centre of the curb chain to the other cheek, for the purpose of preventing the horse from seizing the cheek of the bit in his mouth.

**Liquation**—In metallurgy, is the process of separating, by a regulated heat, an easily fusible metal from one less fusible, with which it is combined.

**Liquids**, *vide* Boiling Point.

**List, Unattached**, *vide* Unattached List.

**Listening Galleries**, *vide* Galleries.

**Litharge**—Vitrified lead. It is mixed with paint which has been manufactured with boiled oil, and is used as a dryer.

**Litho-fracteur**—An explosive agent known also as "Krebs' explosive." The substance consists in the major part of nitro-glycerine. It is a superior description of dynamite, and contains from 50 to 70 parts of nitro-glycerine, the remainder consisting of nitrate of soda, earthy matter, sand, saw-dust, and powdered coal. This substance was largely used by the Germans during the war of 1870-1. It was also used to destroy the iron guns captured at Paris. For general mining purposes, litho-fracteur is stated to be inferior to gun-cotton.

**Litmus**—A violet-blue dye, prepared chiefly in Holland from a lichen which grows in the Canary and Cape de Verde Islands. It is met with in small cubical cakes of a dusky blue colour, light and easily pulverised. It is used as a chemical test of acidity, being reddened by while the blue is restored by al- ; for this purpose it is employed in the form of a tincture or of d paper coloured with it. A more nient and perhaps more generally l blue test paper is prepared from d cabbage. When this is sliced and . in water, a blue solution is pro- . On this being concentrated by ration, it may be used in the same er as litmus for dyeing paper. The r of such paper is rendered red by and blue by alkalies, while it is ly unaffected by the neutral salts.

**ter**—A sort of stretcher or hurdle n which wounded officers or soldiers rried off the field of battle. It is ally used for the badly wounded, an only be carried lying down. It s 15 lbs. The advantage of this e of transport is, that the patient e placed in it on the ground and ed into the ambulance wagon.

other kind of litter, similar to the t (*q.v.*), as described in the 'Treatise litary Carriages,' is used in warfare. re attached to the saddle by hang- ars on each side of the mule, and oked to the saddle and steadied by ap passed round the body of the When not required for use, they e folded in three. The weight of of litters is 93¾ lbs. The doolie of India is made use of for the purpose as the litter, but is always d on men's shoulders.

**e Shells**—Shells loaded with their ing charge ready for service.

**d, To**—To "set home" the charge projectile in a gun or small-arm. ng is effected either at the muzzle ech, according to the nature of the In muzzle-loading guns, the first tion before loading is to sponge out iece; this being accomplished, the idge is inserted and rammed home, hot or shell then follows, and care be taken that the shot is well ed home, as any space left between rtridge and the shot would render un liable to burst; it is of the st importance that this should be ded to; the gun being loaded is then ed, and primed with a friction tube, it is ready for action. *In loading r M.L.R. guns, special apparatus is* used for lifting the projectile into the mouth of the gun. In the Armstrong guns, which are loaded at the breech, a lubricator is used, which cleans the gun out after every round.

All service small-arms are loaded at the breech, and the result of this system has been to produce great rapidity of fire and less fatigue in loading.

**Loader** — An instrument used with S.B. siege howitzers to steady the shell in the passage down the bore. The fixed iron band which crosses the hollow hemisphere of the loader has a hole in it which embraces the fuze, and which on reaching the bottom of the bore can be easily disengaged.

**Loading Side of a Gun** — Represents the side of the grooves of a gun, by which a projectile passes down the bore of a rifled gun from the muzzle. The studs of the shot press against this side when being loaded, but on being forced out by the explosion of the charge, they press against the other side, termed the *driving* side.

**Loading, Simultaneous**—Firing with fixed ammunition, viz. cartridge and shot all in one.

**Loads on Bridges** — The weight brought upon bridges in the passage of troops, which is as follows :—

"Infantry in fours, in marching order, cause a load of 222 lbs. per lineal foot of roadway; if crowded by a check in front, 560 lbs.

"Cavalry, in marching order, in file, and occupying 12 feet of bridge, cause a load of 116 lbs. per lineal foot of roadway; if in double file, 233 lbs. If crowded by a check and in double file, a load of about 350 lbs.

"Artillery, having the weight unequally distributed, is calculated, the 16-pr. M.L.R. gun, as giving a load of 525 lbs. per lineal foot; the 40-pr. Armstrong gun, 888 lbs."

Under the head of Weight of Animals will be found the actual weight of baggage animals, such as the elephant, camel, and pack bullock. In calculating the load each brings to bear on a bridge, it may be put down as follows :—

44 cwt. may be brought on to one foot of an elephant;

For the camel, 10 cwt. to one foot;

Pack bullock, 3½ cwt. to one foot.

**Loadstone** (Icelandic, *leiderstein* = leading-stone; from the Saxon *lædan*, to lead, whence the English name *lodestone* or *leading-stone*)—A combination of the protoxide and peroxide of iron. This term is applied to the magnetic iron ore, or natural magnet, from an early observation of its most useful directive property by various nations. (*Vide* Magnet.)

**Local Rank,** *vide* Rank, Local.

**Lock, Gun**—Formerly a flintlock attached to naval guns; it was introduced into the British naval service in 1778, and continued in use until 1818, when the double-flinted lock, invented by Sir H. Douglas, was ordered for general use in the navy. This lock was also recommended by that officer for land guns, whether field, siege, or garrison, and the recommendation was strongly backed by the late Sir A. Dickson, of the royal artillery. Subsequently, the discovery of the percussion principle having been made, percussion locks and tubes were introduced; but since the introduction into the navy of Colonel Boxer's friction tube, made with a quill, the percussion lock has been superseded.

**Lock, To**—In draught, this term is applied when putting on the drag or locking chain to a wheel.

**Locking Angle**—The turning angle of carriages, or the angle formed between the gun carriage and limber, when the wheel of the latter comes in contact with the trail.

**Locking Chain**—The chain attached to a gun carriage to retard its progress in steep descents. It is fastened underneath the carriage.

**Locking Plate**—A plate of metal fixed on each side of the trail of a wooden field carriage, at that point where the wheel of the limber, when it is turned round, comes in contact with the trail, called the locking angle. The plate being thus placed, the trail can receive no damage, as the plate acts as a fender.

**Lodging Money**—An allowance made by government to all officers and soldiers for whom there is not sufficient accommodation in barracks. Married non-commissioned officers and soldiers married "with permission" are granted lodging money, when separate rooms are not available, at various rates up to 8s. a week.

**Lodgment**—In gunnery, the hollow or cavity in the under part of the bore, where the shot rests when rammed home; it is formed, in smooth-bore ordnance, after much firing, from the elastic force of the powder acting upon the upper surface of the projectile, and forcing it down, so as to occasion an elliptical indentation.

In fortification, the word means an intrenchment hastily thrown up on a captured breach or outwork, in order to maintain the position against recapture.

**Log Huts**—Huts made of logs of wood. Wherever trees are in abundance, such as in the American and other forests, huts can then be erected without any great expense. They last for years, and can be easily constructed. The 'Soldier's Pocket-book' gives a description of how huts should be put together.

**Log Line,** *vide* Line, Log.

**Logarithm**—The logarithm of a number is the power or exponent of any other number, called the base, to which the latter must be raised to equal that number. For instance, 10 being the base, the logarithm of 100 is 2 ($10^2$), of 1000 ($10^3$), &c.

**Logistics**—With reference to military science, is the study of the military resources of countries, which forms part of the information gathered by the intelligence department (*q. v.*) of armies.

**Long Course,** *vide* Schools, Military.

**Long Light, G.S.,** *vide* Light, Long G.S.

**Longe**—The training ground for the instruction of a young horse, to render him quiet, tractable, and supple; to give him free and proper use of his limbs, to form his paces, and to prepare him in all respects for the cavalry service.

**Longitude**—In geography, "signifies, with reference to the earth, its extent from east to west, in contradistinction to its latitude, or extent from one pole to another. The longitude of a place is its distance from some given point called the meridian, which is reckoned either east or west. The English reckon from the meridian of Greenwich. The longitude of a heavenly body is the arc of the ecliptic intercepted between the first points of Aries and the circle of latitude passing through the body. It is measured from west to east, entirely round the circle."

**Loophole**—An opening or small embrasure, in military and other buildings, for musketry fire. In fieldworks, loopholes are made with sandbags and other contrivances, which are laid down in all works on fortification.

**Loot**—A term for plunder or pillage, commonly used in India.

**Low Pressure**—The term low pressure was formerly applied to a condensing engine, which was worked with steam at the pressure of the atmosphere, or even under, hence it was called a *low-pressure* engine; but this nature of engine is as often worked with steam at a pressure of several atmospheres as at low pressure; so that this distinctive name may be said to have ceased.

**Lubrication** — The act of applying grease, oil, or any fatty substance, to surfaces which come in contact with each other. For the composition used in the lubrication of axle-arms, *vide* Grease.

**Lubricator, Cartridge** — Consists of two thin cups of tinned iron soldered together, containing a mixture of equal parts of tallow and linseed oil, attached to a wad of felt, backed by millboard. This lubricator is inserted into the cartridge and placed on the top of the powder. Lubricators are used with B.L. guns to cleanse the bore from leadings, and to save the trouble and delay of sponging the gun after each round.

**Lug**—The ear or loop formerly cast on a mortar shell.

**Lunette** (French, *lune* = moon) — In fortification, a work larger than a redan, consisting of two faces and two flanks. It is much used in field fortification, and is sometimes placed on the capitals of the works in a permanent fortification, in advance of the glacis, to cover some ground which it is desirable to occupy.

**Lute**—Chemists' clay or loam. It is used in closing a retort placed in a receiver for the purpose of excluding the air. There is also a mixture termed *lute composition* used for keeping the bungs of powder cases air-tight, and on the lid of metal-lined and metal cases to exclude the air as much as possible; it is composed of equal parts of tallow and bees-wax.

## M.

**Mace**—A military weapon, a club of metal, used in the early Anglo-Saxon period. It continued to be in use up to the middle of the sixteenth century, when it was exchanged for the pistol.

Nowadays, as a relic of olden times, the mace is still borne before magistrates. By the old English writers it is used synonymously with sceptre.

**Machicolation** — A term applied to openings at the tops of old castles and fortifications, through which combustibles, melted lead, and stones, were dropped on the heads of the assailants.

**Machicoulis Galleries**—One of the means of defence for protecting the entrance and badly flanked parts of a building. They are constructed over the entrance of a house or enclosure, or over posts where an opening is liable to be effected, the floor being perforated to enable the defenders to fire downwards. A balcony may be converted into a machicoulis gallery by making the front and sides bullet-proof, and forming openings in the floor, so as to enable a perpendicular musketry fire to be directed upon the enemy below. Special precautions must be taken if the building is likely to be subjected to artillery fire, to throw up earthen parapets around the walls. An exposed doorway may also be protected by a blindage, or row of stout timbers touching each other and resting against the wall at an angle of about 45°. Sandbags or rammed earth must be placed over the timbers. Other means of defence will also suggest themselves to the officer in command for strengthening his position.

**Machine** — In a general sense, is described as "anything that is used to augment or to regulate moving forces or powers. The term is generally restricted to a certain class of agents which seem to hold a middle place between the simple tools and the more complicated, called engines; this distinction, however, has not a place in a scientific point of view; all such compound agents being really machines, the parts of which they are composed being mechanical powers."

**Machine, Boring,** *vide* Boring Machine.

**Machinery**—A general term applied to mechanical combinations of parts for creating power or producing work, which may otherwise be, more or less perfectly, made with the hand. The application of this subject is so universal and so varied that it will only be possible in a work of this kind to direct attention to the great and continued improvement taking place in the mechanical contrivances of the present day, which, with the aid of steam, play such a conspicuous part in all our military manufacturing establishments.

**Macomber Gun**—A gun invented by Mr. Macomber, C.E., an American. The peculiarity of the gun consists in its stated extraordinary strength. It is a breech-loader, and is provided with a gas-check of Mr. Macomber's own invention, which effectually prevents the escape of gas at the breech.

In a lecture at the United Service Institution, in February 1874, Mr. Macomber gave a description of his gun, and as it may be thought interesting, an extract from his lecture is herewith given:—

"The chamber for holding the powder and the breech of the gun are formed of discs of wrought iron, composed of three different qualites of wrought iron, the softest forming the centre and the hardest the outer circumference of the disc, which are thoroughly welded together, leaving a hole in the centre. After a sufficient number of these are prepared to form the gun, they are roughly engine-turned to bring them to a uniform thickness."

"These discs are then submitted to a process of 'setting' by steel punches (each disc separately), by powerful blows of a steam-hammer, beginning lightly, and increasing gradually until the soft and hard metal have been forced (in a cold state) from centre to circumference to the point of enlargement of the latter, which *commencement* of enlargement is *proof that every portion* of the disc *will* bear *its equal proportion* of a future strain or concussion which it may be subjected to, and which, in the use of gunpowder, cannot exceed the test thus applied."

"After the discs are set, they are welded one at a time upon a mandrel, by the process known to smiths as 'jump welding.'

"Subsequently, the mandrel upon which the discs were forged will be entirely taken out by the process of boring the gun, leaving only the metal which has been subjected to the steam-hammer and punch."

The breech of the gun is surrounded with steel rings, which are forced over it, in a cold state, by a powerful hydraulic press. The gas-check, as has been mentioned before, is Mr. Macomber's own invention. He uses Dyer and Sons' friction primers, and makes use of the strongest powder and of a fine grain; but he states that he would have no objection to use gun-cotton. The weight of the gun he exhibited was 12 cwt., calibre 1¾ inch, weight of shot 3 lbs., initial velocity about 2000 feet per second. The inventor states that at an elevation of 38° the shot attained a range of 9¼ miles.

**Macrometer** (Greek, *makros*, long; *metron*, measure)—An instrument, the invention of Captain Poste, 50th Regiment, by means of which the ranges of distant objects can be determined with rapidity and accuracy.

It consists of two mirrors, disposed somewhat similarly to the mirrors of a marine sextant, the observations being taken much in the same way. One of the mirrors is movable, and is fixed to an arm on which the several distances, from 20 to 2000 yards, are marked. The arm moves over a peculiar curve placed on a part of the instrument called the "fan," and indicating the distances answering to any given inclination of the mirror. The arm, moreover, is fitted with a slide, so as to be capable of being set to any length of base, and this base may either be measured by a chain or may be paced, the slide being set to the line marked "yards" or "paces," as the case may be. The result is always given in yards. When it is required to make an observation, two men take up a position so as to form a triangle with the object, the distance of which it is desired to ascertain. One of the two observers, by means of an optical square, places himself so as to be at right angles with the distant object and the second observer, by whom the macrometer is used.

From experiments made with this instrument, the distance of moving objects has been ascertained with very great accuracy, and in the case of stationary objects the error has been found to be less than 1 per cent. The notation of the instrument admits of the units being taken to represent chains and links; thus 835 would be 8 chains 35 links.

**Mad Staggers**—A cerebral affection with which horses are sometimes affected. There are two different symptoms of staggers, the *sleepy* and *mad* staggers. The former implies the dull stage, which indicates that the brain is oppressed; the latter denotes the furious stage, when the brain has become acutely inflamed. Overfeeding is the origin of the disease.

Mayhew gives the following as the treatment which should be pursued:—

"The best remedy when a horse has gorged himself is to keep him from drinking and to administer a quart of any oil. Oil is preferable to the solution of aloes. Should no amendment be detected, in six hours repeat the dose. In another six hours give another dose, with twenty drops of croton oil in it. When another period has elapsed, should no improvement have taken place, give thirty drops of croton in another quart of oil. Should none of these drinks take effect, the round must once more be gone over. However, on the slightest amendment, stop all medicine. The following signs announce the approach of mad staggers. The lid is raised, and the eye assumes an unnatural brightness. The nasal membrane reddens, the surface becomes as hot as it was previously deficient in warmth, the movements are quick and jerking. The breath is no longer laborious; it is rapid, sharp, and drawn with a kind of panting action. The whole appearance is altered, and the characteristics of approaching frenzy can hardly be mistaken."

**Magazine**—This name is given to a store-house or small arsenal in India, what Lieutenant Collen, R.A., in his prize essay of 1872 on arsenals, would designate as a second-*class arsenal,* as possessing within it the stores, guns, small-arms, &c. of the army dependent on it, and having the means of making or repairing certain warlike stores.

**Magazine, Expense,** *vide* Expense Magazines.

**Magazine, Main**—The principal magazine in a work or battery, in which there is more than one magazine.

**Magazine, Portable,** *vide* Portable Magazine.

**Magazine, Powder**—A receptacle for the storage of gunpowder. Powder is stored in barrels, which are placed in some magazines in racks or "bays"; in others the barrels are piled pyramidally from the floor upwards, without any support from racks. In powder magazines fitted with racks, one of the racks should be left empty for the sake of shifting the powder, or the barrels may be rolled in their own compartments, which would answer the purpose. During fine and dry weather, magazines may be opened daily to air, if necessary, but during damp and wet weather they must be kept closed, until a break in the weather takes place, when advantage should be taken of a dry day, especially in India, during the monsoon or rains, to open them.

**Magazines**—Places of deposit for the food and munitions of an army while on a campaign. The organisation and position of such necessary depots form one of the most important duties of the commander of an army, and necessitate his greatest solicitude and care; for when an army sets out from its base of operations, where the main supplies are stored, each day's march takes it farther away from them, and the greatest difficulty would be found after a certain time in feeding the troops, were not a system of small magazines, with here and there a main magazine, advantageously established, say three or four days' march apart.

To keep these magazines filled, a safe and guarded communication must be kept up with the main magazines in rear, upon which the smaller ones are dependent. When the country into which the army is advancing can offer supplies, advantage will of course be taken to draw on it, and when this is the case, the magazines for food should not be indented upon; but as this mode of supply is very precarious, no army can be kept up if a system of magazines is not carried out.

In the days when armies subsisted on pillage, and soldiers became marauders, living on plunder, and seizing, in countries they entered, all the means of subsistence they could put their hands on, magazines were not then thought of; but the organisation of armies in the eighteenth century rendered it very necessary to depend on them for storing food.

The position of such depots will necessarily become a matter of primary importance for the consideration of the general. In these days of railways, when the facility in bringing up stores from the rear is so great, and food can be brought up in abundance, such a means of transport appears to be the best, provided the line is guarded and not likely to fall into the hands of the enemy; there is however this danger that it may, and this a provident commander will take into account. Junctions of important lines of railway form good positions for the principal magazines, from which the transport of food to the army a few marches ahead can be easily performed. Formerly magazines were generally echeloned along main lines of communication at intervals, and if it were necessary to establish further intermediate depots to maintain communication, they were classed according to size and importance, the largest being generally in rear. Jomini recommends that magazines should, when possible, be formed on three main lines, corresponding to centre and wings, to embrace more country and to facilitate supply.

Magazines are usually formed wherever a break in system of carriage occurs, viz. the point of disembarking, where sea transport ends—always a great depot at all events; also where river transport ends and land transport begins, or where rail ends.

Wellington's despatches abound in illustrations of preparatory formations of magazines, and in Hamley's 'Operations of War,' it is shown that the Archduke Charles, one of the greatest generals who confronted Napoleon, gives an illustration of a system of magazines as applied to a supposed advance from Moldau to *Wernitz*, and further shows that, as an army advances, its magazines are established at principal points in rear, at distances varying from 30 to 60 miles, with intermediate temporary depots, and as the army converges towards the objective, magazines are formed on a narrower front.

When an army can be fed by the country round, the magazines for food, as before shown, are not to be indented upon, and care should be taken that food received from the inhabitants is paid for.

During the Franco-German war of 1870–71, the German army corps had supply trains generally attached to the divisions of each corps; these distributed food to the troops—they carried 4 days' rations for men. Then they had a certain number of supply wagons, containing food for men and horses for 6 days; these kept in rear of the corps, and could communicate with the magazines. When travelling by rail, the troops were fed at certain stations, or took in their food at these stations. The whole management of supply appears to have been admirably carried out, and, when so performed, it considerably facilitates operations.

The subject of the formation and position of magazines is one of such vast importance that military men will do well to study the history of past campaigns, when they will observe—to take only one example—how Napoleon, in the wars of the republic, was careful to accumulate great magazines and to keep his communications open, notwithstanding that his troops helped themselves pretty freely off the country they invaded; nevertheless, no general ever realised more than he did the necessity of having accumulated supplies ready to fall back upon, and to keep his communication to the rear carefully guarded.

**Magistral Line**—The trace or outline of a work as the plan of its guiding or *magistral* line. In field fortifications, this line is the interior crest line. In permanent fortifications, it is usually the line of the top of the escarp of each work.

**Magnesium** — A malleable ductile metal, of the colour and brilliancy of silver. When ignited in dry air or in oxygen gas, it burns with extraordinary brilliancy, and is oxidised into magnesia. To prevent it from oxidising, it is prepared with paraffine. It is used in the preparation of *magnesium signal lights*, which burn for one minute with a very brilliant white flame.

**Magnesium Light,** *vide* Light, Magnesium.

**Magnet**—Derives its name from the city of Magnesia, in Asia Minor, where it was first discovered. It was also called the *loadstone* or *leading stone*, from the early navigators believing that the magnet pointed always to the north pole, and that therefore by means of it they could tell the direction of their meridian, and thus be directed aright on their course.

There are two kinds of magnets, *natural* and *artificial*. The former is found in different parts of the world, and is an oxide of iron; the latter is for the most part a straight or bent bar of tempered steel which has been magnetised by the action of other magnets or of the galvanic current. This nature of magnet is used in producing magnetic needles for compasses. A magnet, as is well known, has the power of attracting iron, but is by no means equal in its power to attract throughout its length; for when a magnet passes over a bar of iron, it affects the two points and not the centre, the magnetic force being stronger at each end as the distance increases from the middle of the bar. These extreme points, where the attractive power is greatest, are called the poles. They are designated as *north pole* and *south pole* from the following phenomena, amongst others, exhibited by artificial magnets, as described in Brande and Cox's 'Dictionary':—"The point of the needle which dips below the horizon, and points to the westward of the meridian, is called the *north pole* of the needle, and the elevated one the *south pole*. When the horizontal needle is used, the same terms apply; the end which varies westward being the north pole, and the other the south pole."

A *horseshoe magnet* is used in testing rooms of submarine mining stations, for steadying the deflections of galvanometers, and for other purposes. It weighs 2 lbs. 13 oz., and will support a weight of 13 lbs. 10 oz.

**Mahogany** (*Swietenia mahogani*)—A wood indigenous to the West Indies and the Spanish Main, and naturalised in some parts of India, where it belongs to another genus, and is decidedly inferior to the real mahogany. The latter, however, has been grown in the Botanical Gardens, Calcutta, and pronounced very favourably upon, showing that the true variety may be grown in the East Indies. It is found in some of the Tenasserim gardens, where it appears to flourish. Professor Royle, in his 'Productive Resources of India,' states, "the tree is now common in Northern as well as Southern India."

**Mail** (French, *maille*, from Latin *macula*, a hole or mesh of a net)—Primarily denotes the holes or meshes in a net. It likewise signifies a round iron ring; hence "coat of mail," a coat of armour or steel network, anciently worn for defence.

This word, as is shown in Lieutenant-Colonel J. Luard's 'Dress of the British Soldier,' is the British word *mael*, for iron. The same author states:—"The tunic covered with rings, to which the word mail was afterwards applied by the Norman French, was literally called by the Saxons *gehrynged byrn*, ringed armour."

**Main**—Signifies first in size, rank, or importance. It has many useful compounds attached to it, such as:—

*Main body* of an army, the body of troops, other than those forming the advanced or rear guard.

*Main guard*, a body of men generally of the strength sufficient to guard a person or place from injury or attack. It remains on duty 24 hours before being relieved. Large forts or fortresses have a main guard chosen from the troops garrisoning them, under which guard all disturbers of the peace, drunkards, &c. are placed, as well as all people who cannot by night give an account of themselves, or who do not know the parole.

**Main Magazine,** *vide* Magazine, Main.

**Major**—An officer next below the rank of a lieutenant-colonel. Since the reorganisation of the army, he is a selected man, and his term of service in this rank is for five years, after which, if not re-employed, he is put on half-pay. This does not relate to majors of the artillery and engineers.

The duties of a major depend upon the

nature of the service on which he is employed. In the line, whilst with his regiment, he has to see to the drill and equipment of the men in conjunction with the adjutant. Being a field officer, he is mounted on all parades and in action. In the artillery and engineers, the rank of major has been recently reintroduced, and single batteries of artillery are now commanded by officers of this rank, instead of by a captain, as hitherto. It was in the year 1827 that the rank of major in the artillery was abolished, its holders being made lieutenant-colonels.

It appears that this class of field officer did not exist in the army until the seventeenth century.

**Major, Brigade,** *vide* Brigade Major.

**Major, Fort,** *vide* Fort Major.

**Major-General**—The lowest grade of general officers. His command in peace time in England is that of a district; in India, a division of the army. A brigade of the army is properly a major-general's command. Thus, on service with a large army, a general would command a *corps d'armée*, a lieutenant-general a division, and a major-general a brigade.

**Major, Town,** *vide* Town Major.

**Male Screw,** *vide* Female Screw.

**Malingerer**—One who feigns illness to avoid his work.

**Malleable**—Flexible; ductile; forgeable. In metallurgy, capable of being spread out by heating or by rolling, or under the blows of a hammer. In speaking of iron, it is the term applied to wrought iron.

**Mallenders**—Described by Mayhew as "a scurfy eruption which sometimes appears at the back of the knee of a horse which, if neglected, will degenerate into a troublesome sore ending in a discharge. It is brought on generally by carelessness and neglect on the part of the stable attendant. For the relief of this disease, it is necessary to pay scrupulous attention to cleanliness, giving the animal tonic alterative drinks, as follow:—

| | |
|---|---|
| "*Liquor arsenicalis* .. .. | 1 oz. |
| Tincture of the muriate of iron .. .. .. | 1½ oz. |
| Porter or stout .. .. | 1 quart. |

Mix and give one pint night and morning; *at the same time* apply the following:—

| | |
|---|---|
| "Animal glycerine .. .. | 1 oz. |
| Mercurial ointment .. | 2 drs. |
| Powdered camphor .. | 2 drs. |
| Spermaceti .. .. .. | 1 oz. |

thrice daily, after thoroughly incorporating the ingredients. If the scurf has degenerated into a sore, treat after the manner for cracked heels."

**Mallet**—A wooden hammer. It is used for a variety of purposes in the field, such as driving pickets, tent-pins, &c. The head is made of elm, and the helve of ash. Mallets vary in size and shape, and are made in India of babool or soondry wood. Mallets are also very generally used by mechanics, such as joiners and carpenters, coopers, tinmen, &c.

**Mallet's Mortar**—A monster mortar manufactured some years ago by Mr. Mallet. It consisted at the lower end of a solid cast-iron breech, abutting on which were a series of wrought-iron hoops, following each other in succession up to the muzzle; these were inserted into each other by rebates, and were firmly secured by six iron staves, at equal intervals, about its surface, extending longitudinally the whole length of the mortar. The total weight of the mortar was 50 tons 13½ cwt.; the diameter of the shell 3 feet, and its weight, when unfilled, 26½ cwt. From the experiments made with this mortar, it appears that there was a tendency to separation between the trunnions and the cascable, and consequently there was reason to think that it could never be employed on service.

There is no piece of ordnance as this in the service, but a model of it may be seen in the Royal United Service Institution, Whitehall.

**Maltese Cart**—A cart which can be used with either single or double draught. The two side pieces of the cart form the shafts, and, as described in the 'Treatise on Military Carriages, 1874,' are "bolted across an axle-tree bed, and connected also by a hind ear-bed, splinter-bar, and axis slats." The cart is formed of wood, and is adapted for man draught. Its weight is under 7 cwt.

**Maltese Cross**—A cross worn by the hospitallers and other orders of knighthood. It is termed a cross of eight points.

**Mamelière**—Ancient breast armour. It consisted of one or two round plates.

**Mamootie**—An Indian term for a kind of large-sized hoe, which is used by the natives of India for digging, clearing obstructions on the roads, &c. Mamooties form part of the tools carried with a siege train.

**Man, To**—This term is commonly used in artillery to signify the arming of a battery with men, ready for action.

**Manacle**, *vide* Handcuff.

**Manége**—A school for instruction in horsemanship and for training horses.

**Manby's Life-saving Apparatus**—This apparatus has been superseded by Boxer's life-saving rocket, a 12-pr. (*q. v.*).

**Mandrel**—The spindle which carries the centre chuck of a lathe, and communicates motion to the metal to be turned; in small lathes, it is driven by a pulley.

**Mandril**—A tapered iron roller, on which the first winding bar of a coiled gun is wound round.

**Mange**—An infectious disease which attacks horses when neglected. It is described as "brought on from want of grooming, irregular hours in feeding, coarse diet, and a filthy stable. It is of the first importance, therefore, to be particular in the cleaning of the horse's skin, which, if neglected, generates in it a small insect, upon the presence of which mange depends. Horses are more subject to it in the winter, after putting on their winter coats. The cure for it is as follows:—

"4 parts of sweet oil;
1 part mercurial ointment;
1 part hellebore.

"Have the horse shaved, apply the above, and let it remain on three days; the horse must then be washed with soap until it gets in a lather; he must then be trotted about till he sweats. Let him remain for three days, and then apply the ointment a second time, and after three days he is to be washed again in the manner above detailed; the insects then should all have been killed."

**Manifesto**—A public declaration by a power or state, containing its reasons for entering into a war. This custom dates back to a very early period, but the formality of a manifesto has been considerably relaxed in modern times.

**Manœuvre, To** (French, *manœuvrer*, to drill)—To handle troops with facility; to move or change the position of soldiers on the drill-ground.

**Manœuvres, Military**—The movement and evolution of any large or small body of troops, or, in other words, the handling of a body of men in any position, generally over a large extent of country. In order to instruct generals in tactics, and officers and men in their duties in the field, mimic warfare is carried on yearly, under the name of military manœuvres, by our own and most continental armies. In England, they are known as autumn manœuvres or summer drills.

The introduction of arms of precision having altered the formation of the orders of battle, and the formation of troops, manœuvres have been considerably modified.

**Mantlets**—Musket-proof shields of iron or some other material. They are generally provided at sieges for all embrasures, as a protection to the gunners when working or laying the guns. Mantlets of various kinds have, from time to time, been proposed, either of rope, timber, iron, or steel, but none appear to be approved of, either on account of their weight or, in the case of thin iron plates, from their not being adapted for closing the embrasures of guns liable to be attacked directly or replied to by artillery. The efficiency of tarred-rope mantlets, which were used at Sebastopol, was considerable; they were found to be more protective against musketry fire than timber. Rope mantlets placed in the embrasures of casemates are said to answer the purpose of keeping out the smoke of the guns, which in a confined space like a casemate would be much felt, were it not for some arrangement of this sort. Since the introduction of the Martini-Henry rifle, mantlets of 3-inch rope and of four thicknesses offer no protection against such rifles, though proof against the Snider rifle at all ranges.

**Manual Exercise**, *vide* Exercise, Manual.

**Map** (Latin, *mappa*, a cloth)—A representation on paper, on a reduced scale, of some portion of the globe, by means of conventional signs and other forms. Maps are of three kinds, viz. military *plans* or *maps*, *topographical* and *geogra-*

*phical maps.* The two former are those used for military purposes.

Plans are the representation on a large scale — showing therefore more numerously the details—of a small part of the earth, such as a town, building, fortification, &c. They are generally drawn on a scale of 25 inches to a mile.

A topographical map, of which the Ordnance Survey is a good example, being on a smaller scale, gives fewer details, but embraces a larger extent of ground. It represents the general aspect of the ground, every object being proportionately reduced to the scale adopted, and shown by distinctive marks or conventional signs. Vertical dimensions, such as heights, elevations, &c., being uneven, whilst the paper on which they are represented is flat, are treated in a conventional manner, so that such relief and character are given to the map as will represent the inequalities of that part of the ground represented on paper. The scales (*q. v.*) used for this kind of map are various, the largest being that prepared for the *Kriegsspiel* (6 inches to a mile).

There are, besides, *relief maps*, made of plaster or wood, all the inequalities of the earth's surface being modelled and executed on certain scales. These maps are very useful for the understanding of topographical ones, as they convey to the mind a correct idea of the inequalities.

The method of representing ground by our survey and topographical departments is in four ways: 1st, by contours alone; 2ndly, by vertical *hachures;* 3rdly, horizontal *hachures*, and 4thly, by a combination of contours and horizontal or vertical *hachures.*

A geographical map is a general map of the world or of a large extent of country.

**Maraud, To**—To plunder in time of war in separate small bodies, for personal purposes, and not for the general wants of an army.

In the armies of civilised nations, marauding and plundering are at all times promptly and rigorously repressed, as being considered disgraceful to soldiers. For this purpose, in the British service, the provost-marshal is vested by the Articles of War with exceptional powers, which go so far as summary punishment on any soldier being detected in the act of marauding. (*Vide* Provost Marshal.) It is however difficult to suppress it altogether, in countries that employ irregular troops.

**Marauders**—Men who go in search of plunder. (*Vide* Maraud, To.)

**March**—The moving of a body of troops from one place to another, either on a campaign or in the usual relief from station to station. Troops nowadays are usually conveyed by rail, but march, when there is no railway, the number of miles constituting the regular daily march. The average march for small bodies of troops is from 12 to 15 miles a day. Large bodies, such as *corps d'armée*, composed of 30,000 or 40,000 men, when they have not the advantage of a railway, move slowly, and have been known to accomplish only a mile or less an hour, depending on certain circumstances; but the length of march for such bodies of troops may be put down from 5 to 10 miles per diem.

The slowness of march of large bodies of troops may be judged of by the following account given in Hamley's 'Operations of War.' In 1859, at the passage of the Ticino, Picard's brigade hurried up to support the guard at Magenta, viz. from Novara to Ticino, 9 miles, and took 5 hours. In 1866, the Austrian eighth corps, before Sadowa, took 14 hours to get over 12 miles, the roads being bad and encumbered.

The above instance shows the difficulty bodies of troops, when not aided by railways, have of getting quickly over the ground, except under pressing circumstances, such as Napoleon's march from the Channel to the Rhine, in 1805, viz. 400 miles in 25 days. He had with him then *seven corps d'armée.* Another and more recent instance is that of the second German army, which marched, in 1870, from Metz to the Loire, and averaged 12 miles a day. The ninth corps averaged 13½ miles for the first 9 days. In consequence of urgent orders received at Troyes, it pushed on to Fontainebleau, 76 miles, in 4 days.

The rate of march ordinarily for different troops is as follows:—Infantry, 2¾ miles an hour; field artillery, 3½ miles an hour; horse artillery or cavalry, 4 to 5 miles an hour; but these

**aly apply to small bodies march-**
**ependently. Practically, infantry**
**e bodies can only march at the**
**2 miles an hour. Infantry, being**
**west marchers, necessarily regu-**
**pace of mixed columns.**
**s computed that a division of**
**y of 12 battalions, of 800 men,**
**ng in fours, will occupy about**
**ards. Its artillery (2 batteries),**
**t wagons, and marching by divi-**
**ccupies about 400 yards. A divi-**
***nplete*, including the advanced and**
**r guard, will cover about 7 miles.**
**ody of 36 battalions, forming**
**35,000 men, will cover three times**
**ve ground, and will take a little**
**han three hours to deploy on its**
**A division of cavalry, of 24**
**ons, of 48 files, marching by fours,**
**cupy 1311 yards. Its deployment**
**of its wings, on a ground free from**
**es, takes 8 minutes at a trot, and**
**tes on its centre.**
**following, taken from a French**
**y manual, is the rule given for**
**the time required for a body**
**ps to go over a given distance.**
**ased upon the knowledge that in**
**l a body of infantry marches 8 kilo-**
**(about 8749 yards) in two hours,**
**at a column of cavalry, at a walk**
**ot alternately, gets over a *myria-***
**about 10,936 yards) in 1 hour.**
**D be the length of march; *d*, the**
**e traversed in 1 minute by the**
**n; *l*, the length of the column;**
**time given for delays caused by**
**lt passages, heavy ground across**
**&c.; $t = \frac{l}{d}$, i.e. the time taken**
**left of the column to get over the**
**l covered by the whole body of**
**. $T = t + d' + \frac{D}{d}$, the time**
**ed.**

$$\text{Ex.} = D = 25 \text{ kilometres,}$$
$$d = 66 \text{ metres,}$$
$$l = 1000 \text{ metres,}$$
$$d' = 90 \text{ minutes,}$$
$$t = \frac{1000}{66} = 15,$$
$$T = 15 + 90 + \frac{25000}{66}, \text{ or}$$

**$+ 379 = 484$, *or 8 hours and 4 min.***

**One of the elements of *d'* is the lengthening (*l'*) of a column in a defile; it is accounted for by introducing $\frac{l'}{d}$ in the formula.**

**Troops in England, such as have to march, generally start about 8 A.M. In India, during the hot weather, the march is commenced between 3 and 4 o'clock in the morning; later in the winter, especially if marching in the North-West Provinces.**

**The general principle to be observed in the march of an army is that it should march in as many columns as possible, and each on the largest front; when possible, cavalry and artillery should march by a different road from the infantry. In commencing a campaign or ordinary march, troops should always begin with short marches; then as they begin to get into marching condition, the march should be lengthened. *Forced* marches are only undertaken under extraordinary circumstances, as they cannot be sustained for more than a few days, that is, marches from 20 to 25 miles a day. If prolonged operations are to be carried on, no more than 10 miles a day, with halts, should be reckoned on as a continuance.**

**The instructions for the march of bodies of troops, small or large, are laid down in Sir G. Wolseley's 'Soldier's Pocket-book,' and are fully given in the lectures delivered at Sandhurst on the subject of orders of march and formation of columns, and condensed as follows:—**

**An army consists of two portions, combatant and non-combatant (or train). The first is of primary importance; the second has to provide for the wants of the army, but to keep out of its way.**

***General Maxims.*—Everything to be arranged in column of route in the order in which it is likely to be required. When at a distance from the enemy, ease and comfort of troops to be mainly considered. When near the enemy, everything must give way to tactical considerations.**

**Troops may march by single regiments, by brigades, divisions, or corps. By single regiments is the least fatiguing to men, but only applicable in peace, or at a distance from the enemy. A regiment**

has its own baggage-train, but no provision wagons; special arrangements must be made by contract for supplies. This is usually done by billeting or from magazines previously established at selected halting-places.

Marching by brigades is not common; it is a little easier to men than marching by divisions, but entails breaking up of control and hospitals (usually organised divisionally), also the separation of the three arms.

Marching by divisions is most common, and 6000 to 9000 a convenient number to march together; tactically complete, with proportions of the three arms; complete administratively, with control, hospitals, provision columns, and reserve ammunition. (*Vide* Column of March.)

All experienced officers know that the strength of the soldier (that most precious portion of the capital of a general) cannot be too much economised. It is not so much the actual distance traversed during the day, but the waiting about in heavy marching order before starting, and constant checks on the march—sure to take place when the staff is not up to its duty—which exhaust the strength, depress the spirits, and wear out the patience of the soldier.

Colonel du Vernois, in his 'Studies of Troop Leading,' remarks that—

"Special attention must be devoted to the times for marching off; unnecessary excitement, as a rule, causes it to be forgotten that so large a force as a division, even if divided into several parts, cannot be set in motion at once, and the troops are only tired by being assembled too early. It is impossible to estimate beforehand what hardships are in prospect for the day, and therefore all the greater precaution should be taken to avoid unnecessary fatigue."

The term *march* is also applied to a piece of music composed chiefly for military bands, to accompany the marching of troops, to help them to preserve time and to act as a preventive against fatigue. Marches are played on wind instruments or by the fifes and drums, and are generally some simple popular air. Each *regiment* in the British service has its *special* march for marching past; the fusiliers are allowed to play on that occasion the "British Grenadier."

**March, Column of,** *vide* Column of March.

**March, Order of,** *vide* Order of March.

**March Past**—An expression made use of when a regiment or any larger body of men pass in review order before the sovereign or reviewing officer. It is usually performed in column or quarter-column at quick march or at the double, and with the mounted branch, when so ordered, at a quick trot, canter, or gallop. In England, the "march past" of large bodies of troops is carried out after the completion of the autumn manœuvres or summer drills.

**March, To**—To move in a military manner; to walk in step, and at a certain pace, as practised by soldiers, each individual stepping out at the same time and with the same foot. This mode of marching distinguishes a disciplined body of troops from a mere crowd of men. It is called *marching in step.* In a note at page 41 of 'Staff College Essays,' by Lieutenant Baring, R.A., he shows that marching in step, although reintroduced by Frederick into the Prussian army, dates from a very ancient period. Livy says that the Romans marched "veloce sed æquo pede." It was also practised in the armies of ancient Greece. Marshal Saxe first introduced it into the French army.

In the British service, *slow march* is at the rate of 75 paces, each of 30 inches, in a minute; *quick march,* 116 paces, in which all evolutions are performed; *double,* 150 running paces, with the knees raised high.

**Marines, Royal**—A body of men raised for service as soldiers, either on shore or on board ship, and placed under the control of the Board of Admiralty. The whole regiment is never afloat, only portions of it, the rest being stationed at some of the naval seaport towns. The royal marines were first raised in 1664, and have been considerably strengthened since the commencement of this century. They rank, when acting with the troops of the line, between the 49th and 50th regiments. The royal marines are a non-purchase corps, and the officers, as in the artillery and engineers, rise by seniority. The corps now possesses a

force of artillery, consisting of
panies, which is a most effective
uable body of men. The head-
s of the royal marine artillery
lastney, near Portsmouth. Many
chief garrisons in the south of
l have divisions of the marines
ed in them, such as Woolwich,
m, Portsmouth, Plymouth. The
h of the corps amounts to 14,000
d 287 officers.

**ding**—A punishment (now abo-
which was formerly inflicted on
sent to military prisons for deser-
bad character. In the former case
lier was marked with a D on the
east, and in the latter with B C.
rt of the sentence was performed—
nan was to be handed over to the
owers—by the trumpet-major or
najor, in presence of the adjutant
medical officer, and then entered
regimental records.

**ks**—A stamp or impression. All
ment stores, packages, &c. are
l in such a manner that either in
r on service they shall be easily
uished; and this is absolutely
ry, considering the multifarious
composing an army equipment,
bearing a similar denomination
pearance, are easily mistaken one
other.

**line**—A small line used for wind-
und ropes and cables.

**line Spike**—An iron pointed tool,
splicing ropes.

**quee**—An awning or cover of
forming an officer's tent; a tent
te. Marquees are of two kinds,
*ning* and *sleeping marquees:* the
being used as officers' mess

**quois' Scales**—The following de-
on is given in Heather's 'Treatise
hematical Instruments':—"These
consist of a right-angled triangle,
ch the hypothenuse or longest side
e times the length of the shortest,
vo rectangular rules. Either rule
ot long, and has, parallel to each
edges, two scales, one placed close
edge, and the other immediately
this, the outer being termed the
ial and the inner the natural scale.
ivisions *upon the outer scale are* three times the length of those upon the inner scale, so as to bear the same proportion to each other that the longest side of the triangle bears to the shortest. Each inner or natural scale is, in fact, a simply divided scale of equal parts, having the primary divisions numbered from the left hand to the right throughout the whole extent of the rule. The first primary division on the left hand is subdivided into ten equal parts, and the number of these subdivisions in an inch is marked underneath the scale, and gives it its name. In the artificial scales the zero point is placed in the middle of the edge of the rule, and the primary divisions are numbered both ways from this point to the two ends of the rule, and are every one subdivided into ten equal parts, each of which is consequently three times the length of a subdivision of the corresponding natural scale."

**Married Roll**—A register kept in each regiment, troop, battery, or establishment, in which are inserted the names of all non-commissioned officers and soldiers who are married with permission. All non-commissioned officers holding the rank of staff sergeants of certain grades are permitted to marry, and also sergeants of troops, batteries, or companies, &c., in a certain proportion, as laid down in the regulations. Of the rank and file, 7 per cent. in England and 10 per cent. in India are allowed to marry, and are entered on the married roll; these numbers are calculated upon the establishment of the corps, except in the royal artillery, in which the calculation is made upon the establishment of each battery. No non-commissioned officer or soldier is entitled to have his name placed on the married roll without having obtained the consent of his commanding officer before marriage. In the case of a soldier below the rank of sergeant wishing to marry, he must have completed 7 years' service and be in possession of at least one G.C. badge. If he has a balance in the savings-bank of £5 or upwards, it will be considered a desirable qualification. The fact of the name of a non-commissioned officer or soldier appearing on the married roll ensures *him* and his family certain privileges which are not accorded to men marrying without the consent of their commanding officer.

**Marroons** — Decorations for rockets. They are cubes filled with grained powder, and enveloped with two or three layers of strong twine or marline; to give them more consistency, they are dipped in kit; they are primed by punching a small hole in one corner and inserting quick-match.

**Marsh**—Low boggy land usually or generally covered with water. In reconnoissance (*q. v.*) such should be shown and described; as in the march of an army such an obstacle, if of any extent, might prove very inconvenient, necessitating the change of direction of the march, as marshes, particularly if wet and miry and of the nature of quicksand, could not be crossed like rivers.

**Marshal** — This term was originally applied to an officer in charge of horses, being derived from the old German *mahre*, a horse, and *schalp*, a servant.

**Marshal, Field,** *vide* Field Marshal.

**Martel de Fer** — An offensive weapon in use at the beginning of the thirteenth century. It was in the shape of a pointed hammer or small pickaxe. It is stated to have made sad havoc in mail or armour, and left fatal openings for the passage of the sword or lance.

**Martello Towers**—The name given to the circular towers erected at the commencement of the present century on different parts of our coast, especially Kent and Sussex, at intervals of about a quarter of a mile. They were built to ward off the meditated invasion of Napoleon. Most of them have since been dismantled, and the armaments of others removed. The name is stated to be derived from a fort in Martello Bay, Corsica, which was captured by the British in 1794. The towers that have not been destroyed are garrisoned by either coastguard men or old master gunners.

**Martial Law**—According to the Duke of Wellington, is neither more nor less than the will of the general that commands the army. In fact, martial law means no law at all; therefore the general who declares it, and commands that it shall be carried into execution, is bound to lay down the rules, regulations, and *limits, according* to which his will is to *be carried out.*

The effect of a proclamation of martial law in a district of England is a notice to the inhabitants, that the executive government has taken upon itself, in consequence of the disturbed state brought about either by acts of rebellion or some other seditious rising, the responsibility of superseding the jurisdiction of all the ordinary tribunals for the protection of life, person, and property, and has authorised the military authorities to do whatever they think expedient for the public safety. It would be an extreme measure to resort to martial law, and then only in case of great danger and necessity.

**Martinet**—A term applied to a strict disciplinarian. It is supppsed to have taken its origin from an adjutant of that name, who was in high repute in the French army as a drill officer during the reign of Louis XIV.

**Martingale**—A thong of leather, fastened at the end of the girth under the belly of a horse, and at the other end to the musral, to keep him from rearing.

**Martini-Henry Rifle** — A rifle lately introduced into the British army, and which has superseded the Snider-Enfield, the arm hitherto of the service. The weapon may be termed a compound one, as the barrel is the invention of Mr. Henry and the breech arrangement that of Mr. Martini.

The following explanation of the form of rifling, and the particulars as to the breech mechanism of this new weapon, is taken from Captain Majendie's lecture on this arm:—

"The Henry rifling is a polygonal system of nine or seven sides, the latter having been adopted in the new arm. The angles are broken by ribs, which create re-entering angles, the inscribing circle tangential to the ribs being described with the same radius as the inscribing circle tangent to the plane sides. The twist is 1 in 22, uniform.

"The breech mechanism consists briefly of a swinging block hinged upon a pin passing through its rear end, the recoil being taken by the shoe. The cartridge (Boxer's) is exploded by a direct-acting piston, which is driven by the action of a strong spiral spring within the breech-block. The block is moved by means of a lever to the rear of the trigger-guard. The motion of pushing the lever forward depresses the block, compresses the spring, and rejects the empty cartridge case. When the lever is drawn back, the block is raised and the breech closed, the arm remaining cocked. If desired, the safety bolt can now be employed to secure the gun from going off. There is also an indicator at the side to show if the arm is cocked or not."

The cartridge is on the central-fire system; the bullet is Mr. Henry's. The weight is 480 grains. Weight of powder, 85 grains.[*] Maximum diameter equal to that of the bore, 0·45 inch.

As regards rapidity, a rate of firing, without aiming, of 25 rounds a minute has been obtained; 15 rounds being obtained under the same conditions with the Snider-Enfield.

This rifle, as now issued to the British army, is described as follows in the 'List of Changes in War Matériel':—

"The Martini-Henry rifle is a breech-loading arm on the falling block system.

"The action consists of—

Body,
Block,
Main-spring,
Striker,
Stop-nut,
Lever,
Trigger,
Trigger-spring,
Tumbler,
Tumbler-rest,
Trigger-guard,
Extractor,
and
Indicator,

with the corresponding screws and pins.

"The barrel is made of steel, bored to a mean diameter of 0·45 inch, which is obtained by allowing a 0·449-inch plug to run, and a 0·451-inch plug to reject.

"The bore is slightly enlarged towards the breech, so that a 0·451-inch plug will run down 4 inches from the breech, and a 0·45-inch plug 8 inches. The remainder of the bore is cylindrical.

"The barrel is rifled with 7 grooves, 0·03 inch of the original bore being left between adjacent grooves as lands.

"The depth of the rifling is progressive from the breech for 11 inches, after which it is the same throughout. The pitch of rifling is one turn in 22 inches.

"The barrel is chambered to receive the cartridge, and the chamber is coned ·018 inch to facilitate extraction.

"The stock is in two parts—'butt' and 'fore end.' The butts are of two lengths—viz. 14 inches and 14·5 inches.

"The rifle is sighted to 1400 yards. Weight — of barrel, 3 lbs. 6 oz.; of rifle (without bayonet), about 8 lbs. 12 oz. Length — of barrel, 2 feet 9·22 inches; of rifle (without bayonet), short butt, 4 feet 1 inch; long butt, 4 feet 1½ inch.

"The bayonet is simply the pattern '53 bayonet altered in the socket so as to fit the barrel of the Martini-Henry rifle." (*Vide* Appendix F.)

**Martin's Shell**—An incendiary shell, now obsolete.

**Mask**—In fortification, a casemated redoubt, one or two stories high and 12 yards wide at the capital, which is sometimes added in front of the caponier; a ditch, 10 yards wide, may be formed in front and rear of it. Its salients being made circular and loopholed, a close and powerful fire can be brought to bear upon the enemy if he succeeds in establishing himself in the ravelin. The name *mask* is given to this redoubt, as it acts as an efficient mask or counter-guard to the caponier.

**Masked**—This term is applied to batteries that are hidden or concealed for the purpose of opening upon the enemy unawares.

**Mass** — The mass of a body, or the quantity of matter of which it consists, is the collection of atoms or molecules which composes it. These atoms or molecules, not being in actual contact, are capable of compression and being forced into less dimensions, and a body is either termed porous or dense according to the closeness or otherwise of the atoms that form the mass; thus wood is said to be porous, a cannon-shot dense.

The *mass* of a body is the quotient of its weight divided by $g$: thus $w = mg$ where $w$ = weight, $m$ = mass.

**Massing Guns**—The best mode of successfully silencing the enemy's artillery, or of destroying some special position of his, is by means of a number of guns brought to bear on that point. This system was first introduced by Napoleon at the battles of Wagram, the Moskwa, and Lützen, and subsequently was employed with great effect by the Germans during the war of 1870–71.

---

[*] This weight of powder and bullet has been reduced, and without disparagement *to the good* shooting of the *weapon.*

In the concentration of artillery in action it is not necessary—as shown in 'Short Notes on Field Batteries'—that all the guns should be formed up into one gigantic battery. With pieces commanding a range of 3000 yards, a hundred guns might generally direct their fire on to one spot, without being crowded together, and it is hardly likely so many guns would be required to concentrate their fire. It is further shown that it is important in massing guns, especially under the fire of an enemy, that the guns should come into action as nearly simultaneously as possible; otherwise each battery may be crushed in its turn as it comes up, from the enemy having got the exact range of the battery which first got into position.

**Master-General of the Ordnance**—An officer formerly at the head of the board of ordnance. Before the present regimental organisation of the artillery, all details of the regiment came under the care and superintendence of the master-general. It is stated in the 'History of the Royal Artillery,' by Captain Duncan, that the position of master-general was introduced into the army as early as 1483; at all events, that seems to be the earliest date that the name of such a functionary can be traced. This officer was at the head of the board of ordnance, to which most important duties were assigned; and if any one, as Captain Duncan observes, would wish to learn what the master-general had to do in the seventeenth century, let him go to the Tower and examine the correspondence of Lord Dartmouth, the faithful friend aud servant of Charles II., a professional artilleryman, and James II., a skilled master-general to the last.

The last master-general of the ordnance was Lord Raglan, who died while in command of the British army in the Crimea.

**Master Gunner**—Formerly an ancient office under the crown, as far back as the reign of Henry VIII. The appointment is now filled by pensioned sergeants of artillery. A master gunner, as understood nowadays, is a warrant officer selected from the non-commissioned officers of artillery, whose duty is to take charge of guns, ammunition, stores, &c. in a fortress.

The coast brigade is composed of master gunners (pensioners), and there are 3 classes, 1st, 2nd, and 3rd, containing 16, 26, and 83 respectively.

**Master Tailor** — A competent tailor, attached to each regiment, who has been, if a soldier, pronounced by a board of sergeant master tailors to be efficient and well up to his work, or who has been instructed in the art of tailoring at the Government Clothing Establishment, Pimlico. A civilian tailor may volunteer for the situation; and if so, he will have to pass an examination at the Royal Army Clothing Depot, and be enlisted as a sergeant master tailor.

**Mastic** — A resinous substance which exudes in the form of tears from the *Pistacia lentiscus.* It is a valuable ingredient in varnish, and dissolves either in spirits of wine or oil of turpentine without the aid of heat. To form the varnish, take 3 lbs. of mastic to a gallon of oil of turpentine, strain it after agitation, pour it into a bottle loosely corked, and expose it to the sun and air for a few weeks. This makes a good varnish for painting. What is termed *Indian mastic* is composed of lime (made from shells), oil, and pitch, and is used in India for paying ships' bottoms.

**Match** — The name given to a material, such as cotton, hemp, tow, &c. which is rendered combustible by being dipped or soaked in some ignitible solution. There are two kinds of match familiar to the artilleryman, *quick-match* and *slow-match.* Quick-match is made of different-sized threads—viz. four-, six- and ten-thread—soaked in a solution of gunpowder, mixed with gum arabic and water in a boiling state, and of such consistency that the thread shall be thoroughly coated with it; it is then wound on reels, and gunpowder sifted on it. If it be stiff, and has the coating of powder perfect over the surface, it is serviceable. If it has been bruised or twisted, and the coating of powder removed, it is unserviceable. It is largely used for priming fuzes, &c.

Slow-match is made of slightly twisted hempen rope, soaked in lime-water and saltpetre, and then dried, or it can be prepared by washing the hemp in a lye of water and wood-ashes. It burns at the rate of one yard in eight hours. It is used for lighting portfires, &c.

**Matchlock**—The name formerly given to a small-arm or musket. The earliest muskets were fired by means of a piece of slow-match applied by the hand to the touch-hole. An improvement on this mode of ignition was made at the end of the fourteenth century by a lock being attached to the musket which held the match, and, by pressure applied to the trigger of the lock, it brought the lighted match down on the powder-pan and thus ignited the priming powder. This mode of ignition caused the musket to be called the *matchlock.*

**Material** — In this term is comprehended the stores, &c. used in the several departments of the army in the manufacture of articles for warlike and other purposes. Under the head of Timber is shown the wood formerly used, and where produced, in the manufacture of our O.P. Indian gun carriages.

**Matériel** (French = material of war)—One of the great subdivisions of an army, the *personnel* being the other. The *matériel* comprises all instruments, weapons, machines, or engines of war, designed for the protection of the army, as well as the provisions required for the preservation of life; and, generally, all the baggage, equipments, and stores indispensably necessary to keep an army in efficient condition come under this term.

**Mathematics**—A science which teaches to number and measure whatever is capable of it, comprised under lines, numbers, superficies, or solids.

**Matross**—A name formerly given to an artilleryman. In the early organisation of the British artillery, there were only two trained artillerymen per gun; they consisted of a gunner and his *mate* or *matross.* It was in the year 1783 that the term *gunner* was substituted for that of *matross.* It would appear from this that the mate, or matross, was in fact a gunner. Another explanation of the word is as follows: a man whose business it is to be in the train of artillery next the gunners to assist them in loading, firing, and sponging the guns.

**Matter**—*Everything which has weight* is called *matter*, and a body is a portion of matter limited in every direction. The quantity of matter in a body is called its *mass*, and is measured by its weight.

**Maul**—A heavy wooden hammer similar to a mallet. It is used for driving anything with force, and is in very general use in the field. The head is made of hard wood, iron-bound, and rounded at each end. The weight is nearly 12 lbs.

**Maund**—An Indian weight of 40 seers, or 3200 tolahs. It is also equal to 100 lbs. troy or $82\frac{2}{7}$ lbs. avoirdupois. This is termed the *bazaar* maund. In commerce, however, the *factory* as well as the *bazaar* maund is used; the former is equal to 74 lbs. $10\frac{2}{3}$ oz. avoirdupois.

**Mauser Rifle**—A breech-loading rifle, the invention of Herr Mauser, with which the whole army of Germany, except the contingent of Bavaria, is armed.

Five patterns of this arm, built on the same system, have been adopted by the German authorities, viz. the infantry rifle, the *Jäger* rifle with double trigger, the pioneer rifle, the cavalry carbine, and the wall gun.

The infantry rifle is an *arme à verrou*, firing a metallic cartridge, and arranged for central fire. The barrel is of puddled steel, with a calibre 0·43 inch; its length is 2·78 feet, and that of the rifled part 2·55 feet. The whole length of the rifle is 4·16 feet; with sword-bayonet, 5·70 feet.

Its weight is 10·5 lbs.; with sword-bayonet, 11·22 lbs.

There are 4 circular grooves, with a depth of 0·158 inch; the twist is 0·021 inch.

The weight of cartridge is 648·159 grains; that of the powder-charge, 77·162 grains, and of the bullet, 385·809 grains.

The cavalry carbine, adopted to replace the Chassepôt, with which the German cavalry was armed after the war of 1870–71, is very similar in size to the latter. Its lever is bent on the side, so as not to impede the movements of the horseman. Its cartridge is the same as that of the infantry rifle. (*Vide* Appendix F.)

**Maximum Range** — In gunnery, expresses the extreme range of a projectile either *in vacuo* or in the air. In the former (were it possible), with a given

**Mechanics**—That branch of mathematics which treats of motion, and develops the effects of powers or moving forces, so far as they are applied to engines.

**Médaille Militaire**—A French military medal, instituted by Napoleon III. It is conferred principally on privates and non-commissioned officers for gallantry in the field, and carries with it a pension of £5 a year. The *médaille militaire* is, however, also conferred on field-marshals and generals when they have attained to the highest rank of military honours, that of Grand-Croix of the Legion of Honour. It exhibits the effigy of the founder, surmounted by an eagle, and is attached to a yellow ribbon with a green border. It was, after the Crimean War, bestowed, to a large extent, on British soldiers.

**Medal** (French, *médaille*)—A piece of metal in the form of a coin, not issued or circulated as money, but stamped with a figure or device to preserve the portrait of some eminent person, or the memory of some illustrious action or event. *Military medals* are generally made of silver, sometimes of bronze, manufactured out of the bronze guns taken in battle. Medals are either circular or star-shape; in the latter form is the Maharajpore metal. In the former is stamped on one side the effigy of the sovereign, and on the other some warlike design. They are granted by the sovereign to officers and men after the conclusion of a campaign, to commemorate the part each soldier has taken in it. They are attached to certain coloured ribbons, and are worn on the left breast. In addition to those given for war, medals are given to soldiers for good service. *Humane medals* for saving life are also given by the Humane Society to officers and soldiers, who may wear them with her Majesty's permission; they are worn on the right breast. No foreign medal is allowed to be worn without her Majesty's sanction. (*Vide* Appendix L.)

**Medical Department**—One of the civil departments of the British army, to which are assigned all matters relating to army hygiene, care of sick and *wounded*, hospitals, and ambulances. *It is shown from* the reports of different commissions extending back to the Crimean War that the above subjects have engrossed the attention of the country, and great improvements have been effected in this branch of the military service, especially within the last few years. Doubtless the progress of medical science has had much to do in carrying out all recent improvements, combined with the desire to prolong the valuable life of the soldier. Independent of the humanity of the cause, economy in the saving of life demanded that every effort should be made to preserve the sick and wounded, and this led to the intimate study of sanitary measures (a branch of the medical department) to preserve the health of the soldier, whether in time of peace or war.

It is gathered from the reports of the commissioners on the sanitary condition of the army in 1858 that the percentage of deaths in the foot guards was nearly as 3 to 1 of the civil population, and in the rest of the army as 1½ and 2½ to 1, the cavalry being the most favourable. Various causes were attributed by the commission to account for this mortality; the most important being defective barrack accommodation, which included crowding, want of ventilation, and bad sewerage. This led to certain improvements, viz. increased space of air for the soldier to breathe in, and improved ventilation, drainage, &c.; besides adding comforts, such as improved cooking, recreation rooms, libraries, &c., and causing certain alterations in the soldier's dress. Such then were some of the improvements made towards arresting disease and death in the soldier's daily life.

In the field, even more than in barracks, the want of proper sanitary measures was clearly shown in the percentage of deaths, which occurred at one time in the Crimea, when the rate of mortality was something appalling; but when proper sanitary measures were adopted in May 1856, sickness was reduced to a very low rate, somewhere about 8 per 1000. The importance, therefore, to be attached in camp to cleanliness, drainage, hutting, and good food, cannot be over-estimated.

Under their respective heads will be found the subjects of Hospitals and Ambulances.

The *personnel* of the medical department consists of the director-general, who ranks as a major-general, and is attached to the War Office; surgeon-general, as a brigadier-general, or after 3 years' full-pay service, as a major-general; deputy surgeon-general, as a lieutenant-colonel, or after 5 years' full-pay service, as colonel; surgeon-majors, as majors, under 20 years' service—above that period, as lieutenant-colonels, but junior of the rank; surgeons, as captains, after 6 years' service—as lieutenants, under that period.

**Medical School**, *vide* Schools, Military.

**Medium**—In gunnery, expresses the elastic fluid through which a projectile, after leaving the piece, has to pursue its course, termed the *resisting medium*.

**Melting Point**—In metals, that degree of heat when fusion commences, which, in the under-mentioned, is as follows:—

| | Fahr. |
|---|---|
| Iron and platinum melt at about .. .. .. | 3300° |
| Cast iron .. .. .. | 2786 |
| Copper .. .. .. | 1996 |
| Antimony .. .. .. | 800 |
| Zinc .. .. .. .. | 773 |
| Lead .. .. .. .. | 612 |
| Tin .. .. .. .. | 442 |

**Memorial**—An address in the form of a petition to a sovereign or other authority, able to redress the grievance of the memorialist. Memorials or petitions of the nature above adverted to may be addressed by officers to parliament; they must be written, not printed, and signed by the writer.

**Mensuration**—That branch of practical geometry which teaches the methods of calculating the dimensions and areas of figures, the volumes of solids, &c., from the measurement of certain lines or angles of the figures or solids, which supply the requisite data.

**Mercury** (Hg100)—Is described as "a substance which has only of late years been raised to the dignity of a metal, from the idea that it could not be solidified, and was looked upon as an imperfect or semi-metal, *containing* a principle regarded as pure vitrifiable earth—silica of modern times. In 1859, the knowledge that it could be solidified, acquired by the academicians of St. Petersburg, was first the means of removing the notion of its semi-metallic nature, and of inducing inquiries by several learned chemists, which led to its being recognised as a true metal. Its fluidity at all ordinary temperatures, coupled with its silvery whiteness and metallic lustre, gave it the popular name of *quicksilver*. It was known long before the Christian era, and the Spanish mines at that period yielded large supplies. It is found still in Spain, but other countries yield it, viz. Hungary, Sweden, Peru, New Granada, Mexico, California, and China. With reference to its properties, it is fluid at all temperatures between 39·5° Fahr. and its boiling-point, which is somewhere about 670° or 680°. It solidifies at −40°, and in this state permits of being beaten out under the hammer, welded, &c. like other metals."

Mercury is used in artillery laboratories in the preparation of "fulminate of mercury," for percussion caps, and in taking the density of gunpowder. Its specific gravity is 13·586, at a temperature of 75°. (*Vide* Fulminate of Mercury.)

Spherical shot are floated in mercury to ascertain whether they are homogeneous, and if so, should rest indifferently in any position in the mercury.

**Meridian** (Latin, *meridies*, mid-day)—As explained in works on astronomy and geography, is an imaginary great circle passing through the terrestrial and celestial poles, cutting the equator and equinoctial at right angles. A meridian is supposed to pass through every place on the earth and every point in the heavens, but only 24 are drawn on the globe, through every 15° of the equator and equinoctial, including altogether 360°. The meridians mark the space which, in consequence of the earth's diurnal rotation, the heavenly bodies appear to describe every hour through the 24 in the day. They are sometimes called, therefore, *hour* or *horary circles*. As 15° answer to an hour, 1° answers to four minutes of time, ½° to two minutes, and ¼° to one minute.

**Merlon**—In fortification, is that portion of the parapet contained between two embrasures; it is generally from 15 to 18 feet in length.

**Mess** (Latin, *mensa*, table; or, French, *mets*, dish)—In the British army, a regimental institution for the maintenance of a common table for all the officers in a regiment, who are bound to subscribe an annual subscription, whether present or absent. Married men pay one half if they do not regularly attend the mess, but they pay all contributions to the mess fund. The introduction of messes into the British army has been attended with the happiest results. Officers of all ranks meet together on an equal social footing, and the youngest officer in the regiment is able to enjoy the society of his senior and brother officers without reserve. The advantages of a mess are manifold, and are seen not only in its social value, but also in the means it offers to all ranks of living well and comfortably. A small government allowance (Queen's allowance, *q. v.*) is granted in aid of the expenses of the officers' mess. Messes are extended also to the non-commissioned officers and men of a regiment, who have their several messes under the superintendence of the officer commanding the regiment and the captains of companies.

**Messages**—Communications passing between officials whether in peace or war time. In the former, messages are generally sent by dismounted orderlies, except the communication is urgent, when it is sent by a mounted orderly. In the latter, mounted orderlies are sent between the general and his staff, on subjects relating to the army and requiring expedition. The 'Soldier's Pocket-book' lays down that important messages forwarded to a distance, and where the bearers may fall into the enemy's hands, should be sent in duplicate, one real, the other false; the former to be concealed in a quill about his person, in such a way as is not likely to be discovered, and which way will in peril suggest itself; the latter in the form of a letter. One orderly is not considered safe; one or two more should be sent at certain intervals of time, say *two or three hours* **between each.**

Emissaries sent from besieged cities with messages to relieving forces or to friends should use great wariness to avoid falling into the hands of the enemy; but if they do, they should be able to conceal the message, which in all probability would be in cipher and in only a few words, about their person. The modes resorted to in warfare, to avoid written communications being seized, are numerous.

During the siege of Metz, Marshal Bazaine, desirous of communicating with the government at Tours, sent two emissaries disguised as peasants, who both managed to pass through the German lines; one carried his despatch in cipher inside a hollow tooth, and the other had his message woven in one of his socks.

Carrier pigeons (*q. v.*) very often play an important part in the transmission of messages during hostilities, as they did during the siege of Paris in 1870–71.

**Messman**—A caterer or superintendent of the officers' mess establishment. He is either a civilian or a sergeant of the regiment.

**Metal-lined Cases**—Powder barrels lined with sheet copper, for the purpose of holding prepared cartridges.

Metal-lined cases are used as portable magazines. When tested, they should be perfectly water-tight.

**Metallurgy**—The art of working metals and separating them from their ores.

**Metals**—Elementary bodies capable of combining with oxygen; many of them, during this combination, exhibit the phenomenon of combustion. Metals are distinguished by their great specific gravity, considerable tenacity, hardness, opacity, and property of reflecting the greater part of the light which falls on their surface, giving rise to metallic lustre or brilliancy.

**Methylated Spirit**—Consists of alcohol ($C^4H_5O,HO$), of specific gravity of ·83, mixed with 10 per cent. of wood spirit, or methylic alcohol ($C^2H_3O,HO$), which is one of the products of the destructive distillation of wood. Methylated spirit is used for damping detonating compositions, so as to form them into paste, when they can be handled. It dissolves shellac.

**Mètre**—The French unit of length; equal to 39·371 inches.

**Metric System**—The modern French system of weights and measures, which has the *mètre* for its basis, and which is fixed at the ten-millionth part of the quadrant of the meridian, and equal to 39·37 English inches. (*Vide* Appendix M.)

**Micrometer** (Greek, *mikros*, a little; *metron*, measure)—An instrument for measuring very minute spaces, the thousandth part of an inch being correctly ascertained by it.

**Mile**—The length of the geographical mile varies in different countries. The English *geographical mile* = 1760 yards, or 69½ miles to a degree. A *geometrical mile* consists of 1000 geometrical paces.

**Military**—Anything pertaining to the soldiery. The word comes originally from *miles*, a soldier. The French term *militaire* is used to signify any individual who bears arms for his country or belongs to the profession.

**Military Academy**, *vide* Academy.

**Military Administration**, *vide* Administration, Military.

**Military Asylum, Royal**, *vide* Schools, Military.

**Military Drawing**, *vide* Drawing, Military.

**Military Finance**, *vide* Finance, Army.

**Military Honours**, *vide* Honours, Military.

**Military Law**, *vide* Law, Military.

**Military Pits** (French, *trous de loup*)—Rows of pits in the form of inverted cones or pyramids made before a work, and having a strong palisade or stake in the centre of each. To prevent the enemy's riflemen from making use of them, they should be made either too deep or too shallow, that is, either 8 feet or 2½ feet deep. The diameter of the deep pits at the top is 6 feet, and 1 foot at the bottom; that of the shallow pits, 3 feet square at the top, and not more than 2½ feet deep. The usual position for military pits is beyond the counterscarp, and principally opposite the salient angles. They would form an obstacle to cavalry. One man can construct two deep pits per day in easy soil, and ten shallow pits under the same circumstances.

**Military Police**, *vide* Police, *Military*.

**Military Schools**, *vide* Schools, Military.

**Military Secretary**—An officer attached to the staff of the commander-in-chief, to governors of provinces, and to an officer commanding an army in the field. His duties to some extent are confidential, and he relieves the officer under whom he is serving of a great deal of personal correspondence. He adds to his other duties sometimes that of aide-de-camp.

An *Assistant Military Secretary* for the British army, in addition to the Assistant Military Secretary for India, is also allowed at the Horse Guards; they receive the relative rank of colonel, if not of that rank. (*Vide* Staff.)

**Military Stores**, *vide* Stores.

**Military Telegraphy**, *vide* Telegraphy.

**Military Train**—A corps raised after the Crimean War for the purpose of performing the transport duties of an army during a campaign. Subsequently it was amalgamated into the control department under the name of Transport Branch.

In organising transport for a campaign, Lord Strathnairn's committee, some years ago, proposed one general military train to provide for all the requirements of an army, and this seems to be the view of all staff and general officers. Regimental officers however prefer each department by itself, regiments objecting to parting with their transport. The true principle appears to be the minimum amount of regimental transport.

**Militia** (Latin, *miles*, a soldier)—A domestic force for the defence of a nation, as distinguished from the regular army. The name militia was known in Queen Elizabeth's time, but as late as 1641 it appears to have been a novel expression. Under other names, however, the militia was a very ancient body. The early Anglo-Saxons had their *fyrd*, or general army of the population. This term continued as late as Henry I., and it was in the midst of the London militia or fyrd, which were under his personal command, that Harold fell at Hastings. *Trainbands*, a force partaking of the nature of militia and volunteers, were, in the reign of James I., substituted for the fyrd, and the term was in use, as applied to the London militia, till the middle of the last century.

During the Civil War, the militia or trainbands were generally on the side of parliament, and the London regiments played an important part in the struggle.

In those days the militia were composed of horse and foot.

At the Restoration, some important acts were passed, placing the militia under the control of the king, and fixing the basis on which it rested until 1757.

In 1757 an act was passed which regulated the militia until 1803. The ballot was then introduced, in case a sufficient number of volunteers did not come forward.

At the present day the militia of the United Kingdom, which forms with the volunteers the auxiliary forces of the country, is raised practically by voluntary recruitment; but should volunteering fail, a levy by ballot would probably be resorted to upon all the inhabitants of a county, between the ages of 18 and 35. The power of making this ballot always exists, and would by law have to be enforced, but for the Militia Ballot Suspension Act, which, when the measure is unnecessary, is passed from year to year. Many classes are exempt from the ballot. The militia is subject to the Articles of War during the period of training and embodiment. As regards the former, they are bound to assemble annually for 28 days; as regards the latter, the government can embody the whole or part of the force at any national crisis, which has been done from time to time. The quota of the United Kingdom, according to the parliamentary returns of 1875, is about 139,000 men (*vide* Appendix E), of whom only 103,000 are likely to be enrolled; this number includes 16,839 artillerymen. The militia do not leave the country except voluntarily, and then only by special permission of parliament. The value of this force cannot be too highly extolled, enabling the country in troublesome times to set free the regular army for aggressive operations; and, if necessary, the militia can be sent abroad, as a portion of it was to the Mediterranean during the *Crimean War.* (*Vide* Appendix A.)

Local regiments of militia, which are divided into heavy, light, rifles, and Highland infantry, are distributed in different counties whose names they bear. Every county has its regiment of militia, the larger ones having several. In case of mobilisation (*q. v.*) they would be attached to the different *corps d'armée* according to the scheme laid down in 1875. The permanent head-quarters of the militia of a county is at the brigade depot of a subdistrict, where the adjutant and permanent staff live. Recruiting is carried on mainly at head-quarters, by the recruiting officer, and the adjutant and permanent staff, or by militiamen themselves who bring friends. No enlisting money is given, but a militia volunteer receives a bounty of £6, payable partly on joining, and partly by instalments after each period of training. All matters relating to this force, such as the calling out, date of training, inspection, promotion, examination of officers, and correspondence, goes to the Inspector-General of Auxiliary Forces. First commissions in the militia are given by the Secretary of State for War, on the recommendation of lords-lieutenants of the counties.

**Militia Adjutant**—An officer appointed to each regiment of militia to superintend the drill and instruction of the regiment. He is taken from the regular army. The following are the regulations recently issued relative to the duties of adjutants of militia:—

"1. The militia adjutant will be, during the non-training period, the representative at the brigade depot of the officer commanding the militia battalion or battalions.

"2. He will raise and enrol all recruits for the militia battalion or battalions, and superintend the out-station recruiting for the army and the militia as required.

"3. He will have military charge of the militia staff during the non-training period, and the military charge and supervision of the drill of the militia recruits when they are trained in large bodies; militia recruits, when they come up singly or in small numbers, will be attached to squads of line recruits, and they will in that case be under the supervision of the officer of the brigade depot.

"4. The duties specified in the foregoing paragraphs will have priority over all others, but when militia adjutants are not employed upon them, they will be liable to perform such other depot and subdistrict duties as the officer commanding the brigade depot or subdistrict may direct."

**Militia Artillery**—Forms a large body of artillery in addition to that of the regular forces of Great Britain.

Formerly the militia artillery was called upon to exercise with all kinds of ordnance, but since 1873 they only practise with garrison and coast guns. Each regiment, however, has some Armstrong guns for the drill of recruits; but, from the absence of horses, its organisation into batteries remains incomplete. The places of meeting chosen for the yearly drills (two months for recruits, and one for a regiment) are some fortified points of the coast, where the men are taught to exercise with garrison and field pieces.

There are 30 regiments of artillery, composed of—

| | |
|---|---|
| 796 | officers, |
| 66 | surgeons, |
| 15,978 | men, or |
| 16,839 | all ranks. |

(*Vide* Appendix E.)

**Militia Reserve**—A force created by the act of 1867; its numbers not to exceed one-fourth of militia quota; the men to be enlisted for 5 years, during which time they remain on the strength of militia regiments, but are liable to be drafted into the army in time of war.

**Mill**—A machine for grinding or pulverising any grain, fruit, or other substance. The power employed to turn a mill is sometimes *wind*, *water*, or *steam*. Mills are often wanted during a campaign for grinding corn into flour; and, therefore, in the reconnoissance of a country, it should be distinctly shown whether they are available, for without them a supply of corn may be valueless, or, as Marshal Marmont expresses it, "without them an army might starve among heaps of corn."

The French, in the Peninsula, suffered severely from the want of mills, so much so that, before Torres Vedras, they had to beat out the corn between stones. Napoleon also felt great want of them in Russia, and suffered severely. During the Crimean War a ship was fitted out with mills, which ground 24,000 lbs. of wheat daily.

As a supply of bread must depend on flour, the importance of mills will be understood, and portable mills should be taken with every force proceeding on service.

**Mill Cake**, *vide* Cake, Mill.

**Millar's Guns**—Introduced into the service by General Millar in 1827. The thickness of metal at the breech is considerable, and comparatively slight in the chase. Two of his 8-inch guns are still in the service. Besides these guns, General Millar also introduced the 10-inch and 8-inch iron howitzers and the present L.S. S.B. iron mortars.

**Millbank**—A large prison, situated on the banks of the Thames, Chelsea. All soldiers under sentence of courts-martial for lengthened terms of imprisonment in England are committed to the military division of this prison.

Soldiers also sent from abroad under punishment for lengthened periods are generally sent to Millbank, or to the military prison in the district in which they disembark.

**Mills, Powder**—The buildings in which gunpowder is manufactured. They consist of the following: charcoal furnaces, a sulphur house for distilling the sulphur, a saltpetre refinery, mixing, incorporating, bruising or breaking-down, press, granulating, dusting, glazing, and drying houses, with sundry charge magazines; the latter are required in each process of the manufacture for storing the charges in until removed to other manufacturing houses. A small chemical laboratory is also attached.

**Mines**—Excavations made in the earth or in solid rock, in which gunpowder or some other combustible is placed and fired, for the purpose of rending and loosening the surrounding soil. This method is commonly resorted to in quarries and such-like soils, and is known as *civil mining*, in contradistinction to *military mining*, which takes place at less depth in the ground, and is carried on in a somewhat different manner. In military mining, the object is to destroy, by explosion, an enemy's troops or works, as well as works abandoned and no longer defensible, in order that an enemy may not use them. To effect this, the mode of proceeding is to sink a shaft, and to run a gallery from the bottom of the shaft in whatever direction it may be required. Shafts are sunk by means of frames of wood composed of pieces, two of which are long and two short, the sides being supported either wholly or partially by wooden lining; on arriving at the necessary depth, the excavation, now termed the gallery, is carried on in a horizontal or inclining direction, the miner supporting the top and sides of his excavation with wooden linings, unless the soil should prove of sufficient tenacity to require only the top of the gallery to be supported. Small galleries run out from the main gallery are termed branches, when their dimensions are under 3 feet by 4 feet. (*Vide* Galleries.)

For the charges of mines in which gunpowder only should be used, the following rules can be taken in computing the quantity of powder necessary to raise a given volume of the earth, as for example, a cubic yard. This quantity will vary according to the weight and tenacity of the soil, but when ascertained by experiment, the rule for determining the charge is clear, viz. to take $\frac{11}{6}$ of the cube of the line of least resistance for the volume, then multiply the result so obtained (reduced to cubic yards) by the quantity of powder required to raise 1 cubic yard, this latter quantity being variable under different circumstances of soil. But in ground of ordinary weight and tenacity, it has been found that by taking $\frac{1}{10}$ of the cube of the line of least resistance in feet, the proper charge of powder for common mines is given in pounds. The line drawn from the charge perpendicular to the surface is called the "line of least resistance." (*Vide* 'Aide-Mémoire.')

**Minié Rifle**—A rifle introduced some years ago and adapted for firing the Minié bullet, the peculiarity of which bullet was that it had an iron cup placed in a cavity at the base, which, on the rifle being fired, expanded the lead into the grooves of the barrel. In 1851 a rifle musket of the Minié pattern was supplied to the English army, but only to a limited extent; it was used in the Crimea, at the battles of the Alma and Inkerman. Notwithstanding its many advantages, it was found to be defective in practice, and was superseded by the Enfield rifle in 1853.

**Minim**—The sixtieth part of a fluid drachm.

**Minister of War** — The responsible head of the army, in whom rests the actual government of the army, the sovereign being the virtual head. (*Vide* Secretary of State for War.)

**Minute** — A measure of time, the sixtieth part of an hour; a measure of an angle; the sixtieth part of a degree of a circle.

**Minute Guns** — Guns fired on the interment of an officer of rank, or of some high personage of the realm. The officer to whom these honours are paid must have been above the rank of colonel in the army, or of commodore in the navy, and have died on service.

**Minutes**—A brief or rough report of the proceedings of a society or council drawn up by the secretary; they are so called from being taken down shortly, and in *minute* or small writing, to be afterwards engrossed.

**Mirror** (French, *miroir*)—A looking-glass or any polished surface capable of reflecting images by means of light. That used in the artillery service is a small circular looking-glass for examining the bores of guns.

**Missile**—A projectile, or a weapon that is thrown by the hand, or any projectile that carries death with it.

**Mitford's Percussion Bullet**—This is merely an ordinary Enfield bullet, having a chamber down its longer axis, to within $\frac{1}{3}$ inch of the hollow; this chamber contains 4½ grains of detonating composition; and the bottom is closed with wax. It is intended to explode ammunition wagons.

**Mitrailleur,** or **Mitrailleuse** — A machine gun intended to throw *mitraille*, that is, groups of small projectiles, independently, to distances of 1000 yards, and to be used against troops under certain circumstances. This nature of gun was known in the French army upwards of a hundred years ago. It is thus described in an old French military dictionary:—"*Orgues*, ou un *Orgue*, sont plusieurs canons de mousquets disposés de suite sur un même fût, les lumières répondant les unes aux autres, en sorte qu'une même trainée met le feu à tous les canons à la fois."

There are several types of mitrailleurs, such as the *Gatling* gun (*q. v.*); the *French* mitrailleur; the *Bavarian;* the mitrailleurs of *Montigny* (*q. v.*) and *Christophe;* the mitrailleur of *Nobel*, and the mitrailleurs of *Winborg* and *Palmcrantz*. The committee appointed to report on the several natures of mitrailleurs gave their decided opinion in favour of the adoption of the Gatling gun in a modified form, to be treated purely as a defensive weapon, and to be generally intrenched and kept as far as possible from artillery fire. This led to the introduction of the Gatling gun into the British army, the more recent construction of which presents several improvements on the original.

On the first introduction of the mitrailleur it was thought it would be an improvement on case shot, the efficacy of which, it was considered, would be reduced by the use of rifled ordnance. This however was found to be an erroneous opinion, and that the use of the mitrailleur was chiefly applicable to positions where it would act as a sure and rapid infantry fire, in fact, in positions where infantry fire was not available.

Major Fosbery, V.C., of the Bengal Staff Corps, who interested himself very much on the subject of mitrailleurs, and submitted a report some years ago to the India Office on the trials carried out by the Montigny mitrailleur, does not recommend this arm as a substitute for artillery—and this is now a very general opinion—but as an addition to the proper complement of that arm in the field, for the defence of roads, bridges, and defiles; for the attacks of mountain passes; for flanking short pieces of works; for covering the landing of troops. From its portability it can be carried up and fired from the cross-trees of a ship. Such a weapon would be especially useful in India, for the protection of isolated positions.

During the Franco-German war, there were many instances of the value of the mitrailleur, and the good turn it served the French in some of their actions.

As a matter of course, where so many systems or types of mitrailleur have been invented, there will be different opinions as to the advantages and disadvantages of the several inventions. The Gatling gun appears to answer the purposes required of it: it is durable, not likely soon to get out of order, and discharges a sufficient number of balls in a short space of time to make it a formidable weapon to face, being capable of firing 300 to 400 rounds in a minute. The calibre of the Gatling used in the British service is ·45, the same as that of the Martini-Henry rifle. Few Gatlings, however, up to this date, have been manufactured for the service, and this perhaps is judicious, seeing the improvements that are taking place from time to time in machines of this nature.

A very interesting report is given in the 'Minutes of the Proceedings of the Royal Artillery Institution,' a translation of an extract from the report of the Swedo-Norwegian artillery commission, giving the opinion of the committee on all the different mitrailleurs. From this report it is gathered that the experiments on the mitrailleurs of Winborg and Palmcrantz were considered the most satisfactory, and the advantages of the weapon are thus described:—"All the mechanism is put in motion by a lever working horizontally on the right side of the piece.

"The construction of this mitrailleuse is far simpler and stronger than those of all others known, which at the same time renders it little liable to derangement by rust or fouling."

The *Nobel* mitrailleur is the one used in the Russian army. It is a ten-barrelled gun on the Gatling system, slightly modified by General Gorloff.

Mr. Hale, the inventor of the rocket which is known by his name, has invented a mitrailleur which fires five rockets at a time.

**Mitre Wheel**—A wheel having teeth, formed so as to work at an angle of 45° to the centre line of the shaft on which it is fixed, to move with another wheel of equal size fixed on a shaft at right angles to the former one.

**Mixing the Ingredients**—The first process in the manufacture of gunpowder after the ingredients have been weighed, and previous to submitting them to the incorporating mills. This process is performed by putting the composition into a cylindrical gun-metal or copper drum about 2 feet in diameter, having an axle passing through its centre, on which there are metal flyers like forks. The machinery is so arranged that the flyers and drum revolve in opposite directions at the rate of about 100 revolutions per minute; 5 minutes is sufficient for a thorough mixture. The composition is then drawn off by a " slip " into a canvas bag, capable of holding a 50-lb. charge, which is tightly tied, and taken to the charge magazine. In this state it is called a *green charge* (*q. v.*), and is now ready for the next process, viz. that of incorporation.

**Moat**—A wet or dry ditch, dug round the walls of a town or fortified place.

**Mobilisation**—The act of preparing troops for war. It consists in raising the army from a peace to a war footing, which in England would be to call out the reserves, auxiliary and volunteer forces, to organise the several departments of the service, and to place them in that state of efficiency in cattle, provisions, and munitions, as would render the army compact and in thorough fighting order.

The labours of the staff of an army are directed towards arriving at a great rapidity in mobilisation; the success of a war depending greatly on the celerity with which armies can be got ready previous to their being concentrated on the threatened points, thus enabling them, if necessary, to take the offensive.

The rapidity with which armies can be mobilised has been of late years very great. In 1859, it took thirty-seven days for France to collect on the river Po a force of 104,000 men, with 12,000 more in Italy. In 1866, the Prussian armies (220,000 in number) were placed on the frontiers of Saxony and *Silesia* in a fortnight; and in 1870, *Germany* was able to mobilise her forces in nine days, and to send in eight days more to the French frontier an army of 400,000 soldiers and 1200 guns.

The mobilisation of the British army has been provided for under orders issued by the War Office and Horse Guards. By this scheme, which is not only based upon defensive requirements, but also adapted for offensive warfare as well, 300,000 men will be available within a few days for the defence of the country, and, if necessary, a certain portion of the force can be embarked for a war in foreign countries. The general details will be found in the Monthly Army List of the service; but a short description of the scheme, as officially promulgated towards the end of 1875, is herewith given.

The army will be divided into 8 army corps, consisting, with few exceptions, of troops quartered in the territorial districts allotted to the corps. Each army corps will be divided into 3 divisions, and each corps will have a reserve, under the immediate orders of its own commander. The number of all ranks of each army corps will consist, inclusive of the civil departments, of 36,228 men, 10,585 horses, 1410 carriages, and 90 guns. Each division will be composed of 2 brigades, and will muster 9743 of all ranks, 1805 horses, 344 carriages, and 18 guns.

The cavalry attached to each corps will consist of 3480 men, with 3306 horses, and the artillery will furnish 90 guns, thus giving a total for the 8 *corps d'armée* of a force of 720 guns. There will be besides, attached to each corps, a pontoon train and a body of 1258 engineers, and 300 military police, while the care of the sick and wounded will be secured by the presence of 3185 officers and men and 418 horses, belonging to the medical department. The control department will be allowed a staff of 369 officers and men, 390 horses, and 99 carriages, for the supply of provisions and stores, besides the special staff attached to the bakery and butchery, which will require, in addition, 541 officers and men. 378 horses, and 77 carriages. Each army corps will have 1410 carriages in all.

The first army corps, composed entirely of regulars, will have its head-quarters at Colchester, and each of its divisions at Colchester, Chelmsford, and Gravesend. The second corps will be formed of two-thirds of regulars and one of militia, with head-quarters and first division at Aldershot, a second division at Guildford, and third (entirely of militia) at Dorking. The first division of the third corps will be entirely composed of the foot guards, with head-quarters at Croydon; the second and third divisions, each of militia, will be mobilised at Red Hill and Tunbridge Wells respectively. The first division of each of the other corps will be at Dublin, Salisbury, Chester, York, and Edinburgh, the particular division in each case having its special nucleus of a first brigade of three battalions drawn from the nearest barracks, whilst the head-quarters of the other two divisions are fixed in such a way that will enable them to communicate easily with each other.

By this scheme the defence of the coasts has been provided for by a garrison or sedentary army, made up, to some extent, of the garrison artillery of the regular army and that of the militia and volunteers, and divided into separate commands for Portsmouth, Plymouth, Portland, Dover, Chatham (with Sheerness and Tilbury), Harwich, Pembroke, Edinburgh, Cork, Dublin, Jersey, Guernsey and Alderney. To this garrison army, the volunteers will contribute a valuable contingent by maintaining one-fourth of their number on duty; whilst those of the metropolis would form a distinct camp, stationed at Tilbury, and constantly attended by one-fourth of each regiment.

The yeomanry will be mobilised with the corps stationed near its own county, and will do duty with the regular cavalry or reserve.

**Mobility** (Latin, *mobilitas*, from *moveo*, I move)—Lightness, facility in moving. In warfare it is of the highest importance that the artillery and transport of the army should be as light and movable as is consistent with efficiency. Not only does this term apply to the particular branches above adverted to, but mobility expresses also the facility and rapidity with which an army can traverse a country, when called upon to do battle with the *enemy, which,* combined with concentration of force, is likely to bring matters to a successful issue.

**Model**—A pattern or imitation of anything on a small scale, in wood, stone, wax, or any other convenient substance. Models are not only made for the reduction in size of articles of all sorts, and for the possession of fac-similes of all such works as are either too large to be moved or too expensive to be bought, but they are valuable in a military point of view in giving, in a handy and instructive form, the elevation of ground sketched out in topographical maps (*vide* Maps), and which is also applicable to fortifications, &c.

Under the name of *model* an apparatus has been lately invented by Captain E. Padmore Clark (Instructor of Musketry, Herefordshire Militia), for the purpose of instructing officers and men in the cavalry and infantry drill. The infantry model consists of a miniature regiment of infantry, in metal, and is so formed that the ranks can be simultaneously turned in any direction, and the position of officers and markers is clearly defined.

This apparatus, which is called "Drill Model Apparatus," consists of a battalion of six companies, with mounted and other officers, colour-party, band, and pioneers, complete. Two of the companies are divisible into half-companies, for the purpose of showing the movement of the side-face companies in the formation of a two-deep square in a battalion of *four* companies. There are six small stands to attach to the right or left, or the centre, of each company, for the leading guide in formations of fours to a flank, or for the right guide in retiring in line.

This apparatus will, doubtless, prove very useful in imparting to young officers practical knowledge in this important branch of their profession, and will assist them in clearly understanding the different movements which companies and battalions are called upon to perform on the drill-ground or in the field. The drill model for cavalry is similar, and represents a whole regiment, and the troops and squadrons are divisible on the plan of the infantry model.

**Molecules** (Latin, *moles*, a mass)—The infinitely small material particles of which bodies are conceived to be aggregations.

**Molten Iron**—Iron in a state of fusion.

**Momentum**—The "momentum" of a body is the product of its velocity and quantity of matter, which last is in the compound ratio of its density and magnitude. Let M be the momentum of a body, W its quantity of matter or weight, and $v$ its velocity, then

$$M = Wv, \text{ whence } W = \frac{M}{v} \text{ and } v = \frac{W}{M}.$$

Thus, if a body weighing 20 lbs. be moving with a velocity of 6 feet per second, then $M = Wv = 20 \times 6 = 120$ feet momentum.

**Mom-raughun** (Indian, *mom*, wax; *raughun*, oil)—A composition used for preserving harness and furniture in India. It consists of two parts of bees-wax, two parts of sweet oil or mutton fat, one part of turpentine, and a very small quantity of camphor.

**Moncrieff Carriage,** *vide* Carriage, Moncrieff.

**Money, Smart,** *vide* Smart Money.

**Money, Subsistence,** *vide* Subsistence Money.

**Monk**—A piece of junk or touchwood laid over the priming of a mine to give the miner time to retire.

**Monkey**—A heavy weight for driving piles, and which is dropped from a pile-driving machine.

**Monk's Guns**—Pieces of ordnance cast upon a principle which was brought forward by Mr. Monk in 1838. He designed, amongst his other guns, the 32-prs. known by artillerists as the A, B, and C Monk guns, which are still in the service.

**Montigny Mitrailleur**—One of the many types of mitrailleurs which have been invented of late years. It is thus described by Major Fosbery, V.C., of the Bengal Staff Corps:—"This machine consists of thirty-seven rifled steel barrels, hexagonally formed exteriorly, and fitted and soldered into a wrought-iron tube, somewhat in the form of an ordinary piece of artillery. This has a movable breech-piece, worked by means of a lever, and containing a spring and striker, corresponding with each *barrel*. The whole of the barrels can *be charged* simultaneously by the introduction of a steel plate containing the thirty-seven cartridges; they can be fired independently, and at any interval of time, or the whole may be fired in one second; reloading takes five seconds, and a continuous fire at the rate of ten discharges per minute can be maintained.

"The gun is provided with both vertical and horizontal adjustments, and may be made to sweep horizontally along a line of adjustment between each discharge, or during the discharge itself. As there is no recoil, the gun once laid will continue to throw 28 lbs. weight of projectiles per minute on the same spot, or at various points of any line requiring the same elevation without any further labour than that involved in the working of the lateral adjustment." It appears from Major Fosbery's account, who was sent to Belgium by the English government to report on this mitrailleur, that at 866 yards the hits were 32·12 per cent.

From the report of the special committee appointed to carry out comparative experiments with the Montigny and Gatling mitrailleurs, it would seem that the result is in favour of the latter. In the special competition between this gun and the Montigny mitrailleur of thirty-seven barrels, the former made 618 hits in 3 minutes 31 seconds, in 720 rounds at 600 yards; the Montigny, at the same range and with the same number of rounds, scoring 538 in 4 minutes. With 558 rounds at 800 yards, the result was even more favourable to the Gatling, which made 439 hits in 2 minutes 26 seconds, against the Montigny's 292 in 3 minutes 3 seconds.

**Moorsom's Fuze**—A percussion fuze, made of metal (brass or bronze), and screwed into the shell (naval) like the ordinary naval fuze. This fuze has been superseded by Pettman's fuze, in consequence of its liability to burst prematurely when fired with full service charges.

**Moral**[*] (French)—Means the state of the moral faculties of a man or an army, in contradistinction to the *physique*. Hence it is applied to the assurance which a man feels in conscious superiority.

---

[*] We have preferred keeping the French spelling of the word, as *morale*, as it is often erroneously spelt, has a different meaning

**Morass**—Uncultivated land, saturated with water to such an extent as to be dangerous to walk upon. Such lands, however, can be drained and made useful for cultivation. A morass comes under the head of a military obstacle, and would form, if necessary, a good *point d'appui* for troops to rest upon. (*Vide* Reconnoissance.)

**Morion**—A kind of open helmet, without visor or bever, somewhat resembling a hat. It was commonly worn by arquebusiers and musquetiers. It first appears in the reign of Edward IV.

**Morse Instrument**—An instrument, invented by an American (Dr. S. Morse), for transmitting messages by means of electricity. The system pursued, and by means of which signals can be recorded, consists of an alphabet composed of dots and dashes, marked on a slip of paper that unrolls itself, which are produced by the emission of an electric current of a length of time proportioned to the length of the signal. This system is generally employed on most telegraph lines, as being the simplest, and is used in the field telegraphy of the army.

**Mortar**—A short piece of ordnance made of cast iron or bronze, and having the trunnions in rear of the breech. The bores of bronze mortars are from 1½ to 2 calibres in length, iron mortars being about 2 calibres, and the shape of the chamber a truncated cone or gomer shape, named after a French artillery marshal of that name. Mortars were used by the Turks at the siege of Rhodes in 1522, and introduced into the French artillery in 1634, and were first used afloat in 1679, at the French attack on Algiers. They were then discharged from a bomb ketch. The object of this shaped piece is to throw shells at high angles, generally 45°, for the purpose of bombarding towns, forts, or works of any kind; from their penetrating power, in consequence of the high angles at which they are fired, they are most effective; the shells are also valuable in setting fire to any combustible matter amidst which they may fall, and when carcasses are used, the destruction is very great on falling into dockyards, arsenals, and amongst shipping, &c.

The iron mortars used for land service are the—

13-inch of 36 cwt.
10-inch of 18 cwt.
8-inch of 9 cwt.

Bronze mortars—

5½-inch royal of 1¼ cwt.
4⅖-inch royal of ¾ cwt.

Iron mortars are used in fortresses, and for siege purposes, the 8-inch mortar forming also part of the ordnance of the heavy field batteries used in India. Bronze mortars are very useful in the advance trenches in the attack of fortified places, from the facility in moving them from place to place; and in mountain warfare, from their lightness, they are very valuable. Iron mortars have generally a fixed elevation, viz. 45°, and the length or otherwise of the range is regulated by the charge.

The Germans used rifled mortars in the war of 1870–71, and they were found very effective.

**Mortar, Coehorn,** *vide* Coehorn Mortars.

**Mortar Platform,** *vide* Platform, Mortar.

**Mortar Portion** — The information given under the head of Gun Portion will inform the reader that a mortar portion is similarly constructed; the ditch, however, would have to be made from 23 feet to 26 feet wide, on account of the solid parapet. The mass of earth to be thrown up to form the epaulment being consequently greater than in the gun portion, the working party will have to be increased.

**Mortar Shell**—A hollow projectile of dimensions to fit the pieces, shown under the head of Mortar. Mortar shells are issued loose, but are filled with a charge of bursting-powder at the time they are required. They are fired from mortars at high angles; the larger natures, with the object of setting fire to buildings, ships, or other combustible constructions (and in the attack of a place, they would be especially directed on the gunpowder magazines); the smaller natures, to annoy or drive out troops behind parapets or any particular cover.

**Mortise** (Latin, *mordere*, to bite)—In carpentry, a hole cut in a piece of wood to receive a corresponding projection formed upon another piece.

**Mortise and Tenon** — A description of joint used in wood-work. The extremity of one piece of timber is let into the face of another piece, a tongue being formed at the end of the piece to be let in, which is called a *tenon*, and the hole cut in the face of the other is called a *mortise*.

**Moss Troopers** — Marauders; freebooters; plunderers. They were confined to the districts which divided the Scotch and English territories before the Union. They were banded together in clans, and lived by rapine, and received this denomination from the character of the country over which they travelled in their adventurous mode of life. They were seldom heard of after the Union.

**Mother Liquor**—The water enclosed in the crystals of various salts before they have been finally boiled and pulverised. In the present system of refining saltpetre, which has been adopted for some years past (*vide* Saltpetre), the crystals are so minute that no liquor remains within them; this is a great advantage, and lessens the cost of refining.

**Motion**—The passing of a body from one place to another; the continued and successive change of place. Motion is of two kinds, either uniform or variable, and is produced by force; and upon the nature of the force or forces depends in what manner the body acted upon will move. The simplest case of motion is that of a body moving uniformly in a straight line, or, in other words, traversing equal distances in any equal successive proportions of time whatever, when it is called a *uniform* motion.

The next in simplicity is that of a body moving in a straight line, but not uniformly, or, as it may be described, traversing unequal distances in any equal successive portions of time, when it is called *variable* motion.

The motion is said to be *accelerated* when the distances traversed in equal times are successively greater and greater; and when these distances are less and less, it is said to be *retarded*.

There are three general laws of motion according to Newton's 'Principia':—

1. That a body always perseveres in *its* state of rest, or of uniform motion *in a straight* line, till, acted upon by some extraneous cause, it be made to change its state.

2. That when any force acts upon a body in motion, the change of motion which it produces is the same in magnitude and direction as the effect of the force upon the body at rest. Hence it appears that, if the time during which a constant force acts upon a particle be divided into any number of equal portions, the same change of momentum will be produced by the force during each of these portions of time, and, consequently, the entire change produced by the force during any interval of time will be proportional to the length of this interval.

3. That action and reaction are equal and in opposite directions, and from this law it appears that the changes of momentum produced by different forces in the same time are proportional to the magnitude of the forces as measured by the weights they would support, and are entirely independent of the masses of the bodies upon which the forces act, and of the nature of the connection of the several parts of those bodies.

**Motion, Parallel,** *vide* Parallel Motion.

**Motion, Reciprocating,** *vide* Reciprocating Motion.

**Motive Power**—The whole power or force acting upon any body, or quantity of matter, by which it is put in motion; such as gunpowder acting upon a shot or shell.

**Motto**—In heraldry, a word or short sentence which forms an accompaniment to a coat-of-arms, crest, or household badge. On reference to the Queen's Regulations, it will be found that most regiments have a motto on their standards and colours conferred by royal authority. Regiments which have no colours or standards have the badges, devices, and mottoes borne on their appointments. The origin of the motto, "Dieu et mon droit," which accompanies the royal arms of Great Britain, is stated to be supposed to have been a war-cry, and was used in England at least as early as the time of Henry VI. Its origin is attributed to a saying of Richard I.: "Not we, but God and our right have vanquished France."

**Moulding Earth,** *vide* Earth, Moulding.

**Moulds** — Forms or shapes made in loam or dry sand in which guns are cast. It is considered unnecessary to give an account of the method pursued in forming moulds for casting guns, as this mode of manufacture has been abandoned in the service for that now known as "building up," the gun being built up with a succession of coils of wrought iron.

Shot and shell are cast in moulds made of metal or sand; in the latter case, the sand is similar to that formerly used in casting guns, though a less refractory sand is needed, as the mass of metal is less, and possesses, consequently, a less amount of heat. It is mixed with clay-water to give the moulds form and consistency. In the manufacture of Palliser's projectiles, the heads are cast in metal, or, in other words, chilled, and the bodies in sand. By this method, the head has the full crushing strength, while the body has more tenacity, and probably impresses rather more of its force on the target on impact before it splits away from the head, but the main advantage in casting the bodies in sand is, that the metal is believed to be far less subject to the action of the molecular forces, which may either split it in store or crack it so as to cause rupture in the bore of the gun.

**Mount, To**—An expression variously made use of in military affairs. Thus, *to mount a breach* is to assault it; and *to mount guard* is going on guard; *to mount a gun* is to place it on its carriage.

**Mountain Artillery** — Ordnance of small calibre, especially adapted to mountainous countries. The ordnance forming the equipment of a mountain battery consists of 7-pr. rifled guns, which carry, besides the usual ammunition for such guns, double shell. Such guns, made of steel and 150 lbs. in weight, were used in the Abyssinian campaign, now familiarly known amongst artillerymen as the "Steel Pens" of the service, from the name of the commanding officer of the battery, Major (now Colonel) Penn, R.A. There is in the service a new rifled M.T. gun of 200 lbs. made of steel.

In the mountainous parts of the Punjab, mules or ponies carry this nature of ordnance. In Assam, a country abounding in forest, and subject to much rain, elephants alone are used.

**Mountain Carriages**, *vide* Carriages, Mountain.

**Mountains**—Elevations or eminences on the surface of the globe, consisting of masses of earth or rock, and rising to many thousands of feet in height. They present themselves to the eye in the form of ranges of hills or mountains, and often form the natural boundaries of countries. In warfare, mountains offer a considerable obstacle to an invading army, and, if properly defended, may either stay the advance of an enemy or prevent ingress into the country. The difficulty to be overcome will be still greater if there be other obstacles, such as rivers and a succession of mountain ranges. In such warfare the invading general should use every precaution in examining each step of the way, and gleaning all information in his power from maps, guides, and reconnoissances. Further, he should be careful that he does not fall into a trap, which the enemy may lay for him in feigning retreat, when he is endeavouring to outflank him and get in his rear, thus rendering the position of the invader very precarious. It should therefore be laid down as a maxim that, in mountain operations especially, the flanks and rear of the invading army must be secured, to prevent being surrounded.

One of the great difficulties in this nature of warfare is keeping the communication open with the rear and bringing up food for the army, as mountain ranges, passes, &c. do not afford facility for using wheeled carriage; and the transport, therefore, resolves itself into men and pack animals. Such transport forms but a slow and precarious means of carrying forward supplies, if not well guarded. History affords examples of the difficulty of mountain warfare in transporting the *matériel* of war; thus, for instance, that of Napoleon, the First Consul, whilst effecting the passage of the Alps, with the French army, in that part called the Great and the Little St. Bernard. The carriage of his artillery and stores was a source of great anxiety and difficulty. The exertion, James tells us in his 'Military Dictionary,' of a whole battalion was requisite for the conveyance of one field-piece, with its proportion of ammunition; one half of the regiment could only draw the load, while the other half was obliged to carry the knapsacks, firelocks, camp kettles, and five days' rations.

**Mousing a Hook**—A mode of passing a piece of spun yarn round the point and back of the hook of a block, in order to prevent its disengaging itself from anything to which it may be hooked.

**Mouth**—The aperture of anything, such as the mouth of a cannon, the mouth of an embrasure, the mouth of a river.

**Movement**—The regular and orderly motion of an army for some particular purpose. It is also described as the changes made by an army from place to place, either to take up new camping ground, to engage the enemy, or to avoid him.

Under this term, as described in James' 'Dictionary,' are comprehended all the different evolutions, marches, countermarches, and manœuvres, which are made in tactics, for the purpose of retreating from or of approaching towards an enemy. The science of military movements forms one of the principal features in the character of a great commander. If he be full of resource in this important branch, he may oftentimes defeat an enemy without even coming to blows, for to conceal one's movements requires great art and much ingenuity.

**Movement, Flank,** *vide* Flank Movement.

**Movement, Turning,** *vide* Turning Movement.

**Moving** or **Motive Force** — In mechanics, as described in Brande and Cox's 'Dictionary of Science,' "the cause of the change of velocity in the motion of a body. At any instant it is measured by the increment of momentum, referred to the units of time, and is, therefore, expressed by $m\frac{d}{dt} = m\frac{d^2s}{d^2}$. The unit of moving force is that which in every *unit of time* could impart to the unit of mass a unit of velocity. That part of the moving force which may be conceived to be acting upon each unit of mass of a moving force is often called the accelerating force."

**Mufti** — A term in the army for plain clothes, the opposite of regimental clothing. In the British army, an officer in England is permitted to appear in *mufti* when off duty.

**Mule**—The hybrid between the jackass and the mare. Mules are used chiefly in mountainous countries as beasts of burden. They may be procured in most parts of the world. In the mountainous parts of the Punjab they form the usual draught and carriage for mountain guns. The Indian mules, though smaller in stature than the Spanish or other continental mules, are not weaker; indeed, if anything, they are stronger, and can go through more fatigue. This was shown in the Abyssinian campaign. On a level road a mule will carry about 250 lbs. This, however, would be a heavy load for continuous marching in a hilly country, which proved to be the case in Abyssinia; the mules being unable to carry more than 100 lbs. when the force reached Magdala. (*Vide* Sumpter Mules.)

**Muller**—A hand instrument made of wood and covered with leather; it is used in the laboratory for reducing powder to great fineness. The term is also applied to the painter's stone for mixing paint.

**Multiple** — In arithmetic, any quantity which contains another an exact number of times, without a remainder, is a *multiple* of the latter, and the latter is a *submultiple* or part of the former.

**Muncheel**—A kind of litter which is used on the Madras and Bombay side of India. It is simply a hammock suspended from a horizontal pole, and is carried by two men. It weighs about 20 lbs. To keep the canvas of the cot or hammock at full length, there is a cross piece of wood at the top and bottom. On service it would be used for the same purpose as the doolie of Bengal. Under another name, the muncheel is commonly used to carry people about in the Himalaya Mountains. A large umbrella is used to guard against the sun, and a waterproof piece of cloth, or a blanket, is thrown over the supporting pole to keep off the rain.

**Munitions of War**—Ammunition and military stores of every description.

**Music,** *vide* Schools, Military.

**Musket** (French *mousquet;* from *mouchet*, a sparrow-hawk; in the same way that other shooting implements were named *falcon*, *falconet*, &c.)—The general name given to the arm of an infantry soldier. Muskets were introduced into England before the middle of the sixteenth century. In the 'Hythe Text-book' it is shown that a musket is properly a fire-arm borne on the shoulder; it was applied to the matchlock, and the term firelock to the wheel-lock in this century, and to the flintlock towards the end of the seventeenth century. Latterly both terms seem to have been applied indifferently. In 1839 the percussion principle was introduced, and since then the musket, as it is still called, has been brought to great perfection in the rifled small-arm of the present day.

**Musketry Instruction**—The knowledge imparted to the officers and soldiers of a regiment, to perfect them in the theory and practice of small-arms. The following is the course pursued in all line regiments.

Every year, in the infantry and cavalry, each company and troop in a regiment is struck off duty in turn, to go through the annual course of musketry, under the regimental instructor. This is divided into preliminary drill and practice. The former lasts four days, and consists of position (standing and kneeling), aiming, and judging distance drill, and the teaching of theory; the latter is divided into three periods, and consists in firing a number of rounds at different distances, from 150 to 800 yards—standing, kneeling, or in any position. Volley and independent firing, skirmishing, &c. form part of the course, during which each man fires 90 rounds.

The result of each man's firing is consigned to carefully drawn up tables, and classified by regiments according to the figure of merit. These tables are published yearly in a blue-book.

**Musketry Instructor,** *vide* Instructor of Musketry.

**Musketry Powder**—Comprises the powders used with small-arms and pistols. A powder designated R.F.G.$^2$ is the powder used with the Henry-Martini and Snider rifles.

**Musketry, School of,** *vide* Schools, Military.

**Musquetoon**—A species of musket, but thicker and wider in the bore than the ordinary musket. This arm was used towards the close of the seventeenth century; it is now obsolete. It propelled a ball about 5 oz. in weight.

**Mussuck** (Persian, *musk*, leather)—A leathern bag for carrying water, which is slung on a man's back. Sometimes a pair of mussucks is slung across the back of a pony, mule, or bullock. A leather bag is universally used in India and in other Asiatic countries for carrying water. On the march, water is carried by bheesties in mussucks for the use of the troops.

**Muster** (French, *montrer*, to show, to put forth, to display)—This definition will at once convey the origin of our word "muster" and explain its object, viz. that the troops may show themselves, and be counted over.

**Muster Roll**—A return or list of all troops and establishments, actually present on parade or otherwise accounted for, which is taken on the last day of every month. The presence at muster of all concerned is peremptorily necessary, otherwise an officer or soldier subjects himself to forfeiture of pay, unless leave by competent authority has been obtained. The Queen's Regulations lay down that the presence of the commanding officer is necessary on all *muster parades*, without he is on leave, when the next in command will take the muster and sign the usual documents. The commanding officer's absence on leave is to be noted in the muster roll.

**Mutiny, To**—To mutiny is to rise against lawful authority. The term has long included behaviour, either by word or deed, subversive of discipline, or tending to undermine superior authority.

The acts now constituting mutiny proper are, as stated in the Articles of War, "exciting, causing, or joining in any mutiny or sedition; when present thereat, failing to use the utmost effort to suppress it; when knowing of a mutiny or intended mutiny, failing to give notice of it to the commanding officer; striking a superior officer, or using or offering any violence against him, while in the execution of his duty; disobeying the lawful command of a superior officer." The punishment of the above offences, which extends under certain circumstances to death, is detailed in the articles quoted.

The most recent case of mutiny of an army is that of the Indian army in 1857.

**Mutiny Act**—An act for the punishment of mutiny and desertion. This act, which the British parliament passes from year to year, investing the sovereign with large powers to regulate the good government of the army, was first framed in the reign of William III., and is the immediate ancestor of the one now in force. With the view of placing a check upon the exercise of the military power of the king, the act was passed for six months only at first. This act, which empowers the crown to form articles of war, and to constitute military courts-martial, was renewed soon after its expiration, and has been annually re-enacted, with many alterations and amendments, ever since. The act provides for the assembling and constitution of courts-martial, and a variety of other military duties, and the punishment of military crimes and offences.

**Muzzle, Drooping of,** *vide* Drooping.

**Muzzle-loader**—The name given to all guns, smooth-bore or rifled, which are loaded at the mouth or muzzle, to distinguish them from those loaded at the breech. All the newly made ordnance used in the service are rifled, and loaded at the muzzle, but the first rifled guns (Armstrong's) were breech-loaders. The change from breech-loading to muzzle-loading was brought about, chiefly, from the instability of the system in heavy guns, a want of a reliable breech-closer, and the want also of a suitable percussion fuze. Moreover, the nature of the powder used when heavy breech-loaders were in the service was such as to render the breech apparatus unsafe.

A muzzle-loading gun, as described by Lieutenant-Colonel Owen, R.A., "has a simpler, less costly, and stronger construction; the ammunition is less costly, and a simple fuze, without percussion arrangement, can be used." (*Vide* Appendix B.)

**Muzzle of a Gun**—A term applied to the mouth of a gun.

**Muzzle-pivoting Carriages,** *vide* Carriages, Muzzle-pivoting.

**Muzzle Velocity,** *vide* Velocity.

## N.

**Naick**—An Indian term for a corporal in a native regiment.

**Nail**—A pointed piece of metal which is used as a fastening in wood and iron work, and for other purposes. Nails are of different sizes and material. Iron nails are either wrought, cast, or cut out of sheet-iron; wrought nails are also made from plates rolled for the purpose, and then slit by means of slitting rollers into *nail rods* or split rods of various sizes and qualities, according to the variety of nail required. The various sorts of forged nails are many, numbering upwards of 300, to which are given specific names, as *hurdle*, *scupped*, *mop*, &c., and are known also under the retail terms of *fourpenny*, *sixpenny*, *tenpenny*, &c. Nails are also distinguished after the forms of their heads and points, as *rose*, *clasp*, *diamond*, &c. heads, and *flat*, *sharp*, *spear*, &c. points. The thickness is expressed by the terms *fine*, *bastard*, *strong*; the length of some sorts by direct lineal measure, but it is more usually included in the weight of 1000 of the nails referred to.

**Naphtha**—A bituminous inflammable liquid, known also as *rock-oil*. It is obtained by distillation from petroleum. In the 'Soldier's Pocket-book,' a preparation of naphtha is suggested as a good substance, when set fire to, to throw on a river above where the enemy is making a bridge of boats, either to set fire to the bridge or to throw a light upon his movements, which might make him desist.

**Nasmyth's Hammer,** *vide* Hammer, Steam.

**National Anthem**—A piece of music set to words, and common to all nations. In England the national anthem is "God save the Queen," which is played when troops pay the prescribed honours to the sovereign and members of the royal family; in the latter case only six bars of the anthem are played. The first part of the national anthem may also be played at the salute of a viceroy, at state ceremonials, and at the trooping of colours. The playing of the national anthem is only due to those personages who are entitled, under the regulations, to a royal salute.

**National Defence**—The defence of a state or a nation against invasion.

The national defences of a country consist, besides her armies and reserves, of the navy; of the fortifications, forts, and fortresses built along the coasts, and on some important strategical points, either inland or on the frontier line; of torpedoes laid down for the protection of harbours, arsenals, &c. When these have been found insufficient, an appeal is made to all men able to carry arms to stand up for the defence of the country, and to repulse the invasion. This is called a *levée en masse* (*q. v.*). In England, in the event of a threatened invasion, the volunteers would be called out and mobilised with the different army corps to which they belong.

**National Rifle Association,** *vide* Volunteers.

**Nave**—The central part of a wheel; it is generally composed of a cylindrical block of wood in which the spokes are firmly fixed, and in which the axle-arm works. This has hitherto been the nave of all artillery carriages in the British service, but in the newly constructed wrought-iron carriages the Madras pattern nave, made of metal, with some slight modification, has been adopted.

In the Madras wheel, as originally formed, the nave-box is made of gun-metal, and cast in one piece with one of the plates, but the principle of construction is the same whether it be so united or cast separately. Between the two plates, 12 spokes are placed, so formed that the parts which enter the nave are in close contact with each other, and with their ends forming an arch completely round, but not quite touching, the nave box. The whole construction is then firmly bolted together, with 12 triangular bolts passing through holes in the discs, and fitting into the triangular spaces formed between each spoke by their radiation from each other. These bolts have circular heads, and when driven into their places, their ends are secured outside by nuts. The naves are in two or three parts. The great advantage in the latter is that the top and bottom, as two of its parts are termed, are almost rendered perpetual, whereas in the nave in two parts, if the box wears and therefore becomes unserviceable, the box with bottom, altogether nearly three-fourths of the nave, is rendered useless, and must be renewed; but with the nave in three parts, the box alone is renewable if it wears away.

In the late Madras artillery, the *gun-metal nave* had been in use for the last sixty or seventy years, and no failure of its strength or want of durability had ever been reported. For many reasons it was a great improvement on the *block nave*. Its durability was apparent after the occupation of Burmah in 1852, and subsequent years. In that country, for a long period after it was annexed to the British possessions, gun carriages, Bengal and Madras, had for want of cover to stand out exposed to sun and rain. During that period not a Madras wheel was the worse for exposure, whereas the majority of the Bengal wheels had large deep splits in the wooden naves, which necessitated their being replaced, and the wheels set up afresh.

Very serviceable wooden naves can, if required, be made from the preserved or non-decayed parts of condemned naves put together in three pieces; they are termed *compound* or *joined naves*.

**Nave Box,** *vide* Box, Nave.

**Navez' Electro-ballistic Apparatus,** *vide* Electro-ballistic Apparatus.

**Navez' Pendulum,** *vide* Pendulum, Navez'.

**Near**—Applied to the left-hand or riding horse of a team; to the left feet, fore or hind, of an animal; to the side or stirrup on which the horse is mounted. (*Vide* Off.)

**Necessaries**—In a military sense, are such articles of clothing, &c. as are provided by the state for the soldier on his first entering the army. The articles thus named are known also as the soldier's *kit* (*q. v.*). On troops proceeding to India or the colonies, they are provided besides with a sea kit.

**Neck**—In S.B. guns, the narrowest part of the gun; it is comprised between the muzzle astragal and fillets and the swell of the muzzle. It is also that portion of metal behind the breech ogee, termed the neck of the cascable, and which is contained between the neck fillet and the button astragal.

In fortification, the interior opening of an embrasure is termed the *neck.*

**Needle, Dip of the,** *vide* Dip of the Needle.

**Needle-gun**—A breech-loading rifle, the principle of which rests in the manner the charge is ignited, viz. by means of a pointed piston or "needle" driven—as in the original Prussian needle-gun, into a small case of fulminate contained in and situated between the powder and the bullet of the cartridge, or, as in the Martini-Henry and the Snider, against the cap, which is placed at the base of the cartridge—by the action of a spiral spring or hammer. In the action of opening the breech, the spiral spring is set by the trigger; and thus the trigger, when pulled, releases into operation the spiral spring, which, in its turn, forces the needle into the cartridge and fires the piece. Small-arms of this kind were first adopted by Prussia in 1848, under the name of *Zündnadelgewehr.* Since then, from the defects which were found in this arm, many improvements have been made in the mode of igniting the cartridge in all breech-loaders, and also in the mechanism of the lock, &c. All breech-loaders are needle-guns. (*Vide* Appendix F.)

The German army is now supplied with a greatly improved needle-gun, known by the name of the *Mauser rifle* (q. v.).

**Needles**—These useful articles, which are for the most part made of steel, and are used in sewing, are so well known as to need no description. In certain departments of the army, such as the ordnance and clothing, steel needles are used either by the hand or with a machine known as the "sewing-machine," which may be said now to be invariably employed.

**Netley**—A place situated in the county of Hants, on the shore of the Southampton Water. Its name is well known in the army as possessing one of the finest military hospitals in the world, which is named, after the Queen, the Royal Victoria Hospital. All detachments of invalids, also the orphans of soldiers, on arriving from abroad, are sent at once to Netley, under the officer who has had charge of them during the voyage, accompanied by the medical officer in charge, and are made over, together with their documents, to the commandant of the Royal Victoria Hospital. Troops serving in the surrounding districts are also sent there. The hospital is capable of holding 1000 patients. Netley is also the head-quarters of the female nurses of the army, under the control of a lady named the superintendent-general; a medical school for the training of army surgeons has also been established there. (*Vide* Schools.)

**Neutrality**—The following is the definition given in Brande and Cox's 'Dictionary of Science':—"The condition of a state which does not take part in a war between other states. A neutral nation has the right of furnishing to either of the contending parties all supplies which do not fall within the description of *contraband of war*, and to conclude treaties with either unconnected with the subject of the war. It appears to have been the old principle, with regard to the maritime trade of a neutral nation, that the property of an owner belonging to the hostile country might be seized by a belligerent on board a vessel or vessels belonging to a neutral power; but the general rule now asserted is that the flag covers the cargo; by which means, right of search, except for specific purposes, is rendered unnecessary. By the declaration of March 28, 1854, made on the occasion of the Russian war, England *waived* the right of seizing enemy's property on board a neutral vessel, unless contraband, but did not abandon it."

**New Zealand Cross**—A decoration instituted in the year 1869. The New Zealand Cross was provided in the year 1869, by the government of the colony, with the sanction of the crown, as a reward for acts of distinguished valour similar to those recognised by the Victoria Cross. The fourth clause of the order in council, which subsequently received her Majesty's special sanction, as "fountain of honour," provides that "The distinction shall only be conferred upon those officers or men who, when serving in the presence of the enemy, shall have performed some signal act of valour or devotion to their duty, or who shall have performed any very intrepid action in the public service; and neither rank nor long service, nor wounds, nor any other circumstance or condition whatever, save merit or conspicuous bravery, shall be held to establish a sufficient claim to the honour."

**Night Firing**—The mode pursued, after sunset, of directing any piece of ordnance, but particularly mortars, against the enemy's works, so as to obviate the inconvenience that would take place if they had to be layed at night after each round. The mode is as follows. The direction being known, and the gun or mortar having been properly laid, while it is light, nail the battens to the platforms, touching the felloes of the wheels or trucks or side of the mortar bed. The elevating screw or quoins must also be fixed. A method of laying rifled guns by night will be found under the head of Collimator.

**Nipple**—The passage of communication in percussion arms between the cap and the charge; the percussion cap is placed on the nipple when the firelock is primed, and by the action of the lock the piece is discharged. In breech-loading arms, except in the Snider, there is a different arrangement for igniting the charge, which renders the nipple unnecessary; these are fired by means of a needle or some similar method.

**Nitrate of Silver**—The *most important* of the salts of silver. It is prepared by several methods.

"1. By dissolving pure silver in dilute nitric acid with the aid of heat, and evaporating to crystallisation.

"2. From standard silver dissolved in dilute nitric acid, the solution evaporated to dryness in a porcelain dish, and the residue heated nearly to redness. The nitrate of silver fuses without change, but the nitrate of copper is decomposed, leaving the black oxide of copper; a small portion of the mass is removed from time to time, dissolved in water, the solution filtered, and tested with excess of ammonia. When this reagent ceases to produce a blue colour, the process is completed, and if the residue be treated with water, the solution will yield, on evaporation, crystals of pure nitrate of silver."

A solution of nitrate of silver is a valuable test for detecting the presence of chlorides in saltpetre.

**Nitre**, *vide* Saltpetre.

**Nitric Acid**, *vide* Acid, Nitric.

**Nitrogen** (symbol, N; atomic weight, 14; sp. gr. 0·9713)—This is the gas which exists in the air, and dilutes the oxygen so as to moderate its activity and fit it for the proper maintenance of life, combustion, and numerous other offices it has to fulfil. Nitrogen, in its pure state, is quite free from smell; it instantly extinguishes flame, and cannot support life. Atmospheric air is a mixture of very nearly four measures of nitrogen with one measure of oxygen; it contains, besides, small quantities of other gaseous substances, as vapour of water, carbonic acid, and ammonia.

Nitrogen is also stated to be "an important component of many organic substances, and is remarkable as one of the constituents of most of the fulminating compounds, such as fulminating gold, silver, and mercury."

**Nitro-glycerine** ($C_6H_5N_3O_{18}$), known also as **Glonoin** or **Glonoin Oil**—It is described as "an explosive oil, in many respects analogous to gun-cotton. It is produced by the action of nitric acid, mixed with oil of vitriol, upon glycerine, the sweet substance obtained when oils and fats are steamed. It is one of the most treacherous explosive substances known to chemists, and frightful accidents have been caused by incautiously using it in its crude state. In the course of many endeavours to counteract or reduce the sources of danger attending the use of nitro-glycerine, Mr. Nobel made the important observation that its explosive properties were not reduced, but, on the contrary, somewhat favoured, by mixing the liquid with solid substances, in themselves thoroughly inert. This led to the production of dynamite (*q. v.*). It has been found that the exposure of nitro-glycerine compounds to musketry fire, within ordinary infantry ranges, will cause ignition, and a package of dynamite or litho-fracteur will explode with considerable violence; not so gun-cotton."

**Nolan's Range-finder,** *vide* Range-finder.

**Nomenclature**—As applied to military stores, a systematic classification of words given to each article used in the service.

**Nominal Power**—By this term is understood a steam-engine having a cylinder of given diameter, a given length of stroke, with a uniform pressure upon the piston of 7 lbs. per inch. By the term *actual* power is meant the number of times the engine is capable of lifting 33,000 lbs. 1 foot high per minute.

**Non-combatant**—A man who, although in the army, is not called upon to fight, his duties being restricted to the civil department of the army.

**Non-commissioned Officer**—As the name implies, is an officer without a commission, but who by his position in a regiment, and by virtue of the power attached to that position, exercises control over the private soldiers. Non-commissioned officers, such as troop and battery sergeant-majors and colour sergeants, in cases of misconduct, are liable to revert to the rank and pay of sergeant, at the discretion of their commanding officers, without the intervention of a court-martial, provided they have done nothing to merit a court-martial. All non-commissioned officers, not being army schoolmasters, can be reduced to the ranks either by sentence of a regimental or other *court-martial*, or by order of the commander-in-chief, or, if in the militia, the commandant of the regiment or corps. The Queen's Regulations state that non-commissioned officers may, with their commanding officers' consent, resign their rank or appointments, and revert to the rank or position they may have previously held, but they are not allowed to do so, in order to escape trial by court-martial, without the special sanction of the general officer commanding.

A royal warrant lately issued regulates the pay and position of non-commissioned officers of the army, and gives an entire reclassification of the several grades of non-commissioned officers. By this warrant, staff sergeants and others having special duties to perform, requiring more than ordinary intelligence or application, are elevated to a higher relative position, in some cases rising two classes at a step.

**Non-condensing Engine**—A high-pressure engine, the steam not being condensed after leaving the cylinder, but passing out into the atmosphere after having acted upon the piston.

**Non-conductors**—Substances through which the electric fluid passes with considerable difficulty, or not at all, such as glass, resin, sulphur, silk, hair, wool, the air, &c.

**Non-effective**—In the army, are the officers or men employed on other duties than regimental, such as in staff appointments and the like. Sick and disabled men also come under this category, and so do all officers on retired or half-pay, pensioners, and superannuated officers. The term is used as the primitive or negative of effective.

**Notch**—A nick, a hollow in anything. In gunnery, the groove on the base-ring, or tangent scale, and swell of the muzzle, or on any other sight by which a gun is laid.

**Nullah**—An Indian term, signifying a small stream, or the arm of a river; also the place which was once the bed of a river.

**Numdah** (Persian, *numad*, a coarse cloth)—A species of felt, which is used, amongst other purposes, as a saddle-cloth. The word *numnah* is sometimes used for *numdah*, but in India the latter mode of pronouncing the word is universal.

ı, **Military**—A female hospital ıt. Subsequent to the Crimean n, a staff of female nurses was d on an established footing to upon the sick in all military s. These nurses are placed under rol of a lady styled *Superintend- ral of Army Nurses*, and are at the Netley Hospital.

tion was first called to the great f these attendants by the help l in military hospitals on the t by the sisters of charity, and the Crimean War by the unre- care given to the wounded and liers by a band of self-sacrificing eaded by Miss Nightingale.

-A square or hexagonal metal len block, having a spiral hole its centre, into which a screw l by the interplacement of the of which with those in the nut hesive strength of the hold"

## O.

**n**—The untwisted strands of old t is used in packing shot and riping the vents of guns after cleaning elevating-screws and implements, and also in making sponges. One of the occupations ners in our many jails at home oad is the untwisting or pulling ıe strands of old rope for pur- general use.

—An oath is defined by Paley as lling on God to witness, i.e. to ice of what we say, and invoking geance or renouncing His favour we say be false, or if what we be not performed." By the juris- e of nearly all known nations, it admitted, in one form or another, solemn test of truth in judicial ngs. In military courts-mar- idence is given by all Christians sworn on the Bible, except by cts as profess conscientious objections to oaths, when a solemn affirmation is made.

**Obedience**—Performance of what is enjoined by authority. The first duty of an officer or soldier is obedience to orders. This is the life-spring of an army: without it no body of men can be kept together. It is a principle, therefore, which cannot be too strongly inculcated amongst all ranks. "He who has never learned to obey," said a great authority, "will never be fit to command."

**Object-glass**—In optics, the lens of a telescope or microscope which first receives the rays of light coming directly from the object, and collects them into a focus, where they form an image which is viewed through the eye-glass. Telescopes are largely used in the field.

**Objective**—A technical military term, signifying, as the word implies, the aim or object of the military combinations and movements on the theatre of war.

**Oblique Fire**—Taking the enemy slantwise. Thus, when two batteries bring their fire obliquely upon one point of the enemy's line, they make, what is called, a cross or concentrated fire, which is very destructive upon columns, though not so effective as enfilade fire.

The subject of oblique fire against iron plates is thus described in an interesting article in the *Times*:—"If a pointed projectile strike an iron plate at a less angle than that formed by a tangent to the curve of the head, it will probably glance off, as the tendency of the shoulder will be to slide along the plate, and the point will find a difficulty in 'biting.' If, however, the angle be greater than about 50 degrees, the resistance will approximately be increased in the proportion of the extra thickness to be traversed. In this case the sharp point of the projectile 'bites' the plate on striking, and the shot has a tendency to bring its axis perpendicular to the face of the target; perforation then depends upon the energy with which the projectile may be animated. Thus the side of the *Monarch* (7-inch plates) could be perforated "directly" by a projectile having a zone-energy of 90 foot-tons, but it would require 120 foot-tons to send the same projectile through at an angle of 60 degrees. The defence, therefore, should not rely too much on the chance of shot striking "obliquely"; for the projectiles fired from large modern rifled ordnance would probably perforate all thinly armoured ironclads at all fighting angles and ranges."

**Oblique Order**—Military writers describe this order of battle, as one in which the primitive parallel order has been departed from, with the design of giving the one force, by manœuvring, a superiority over the other, or, in other words, if an army attacks its enemy in flank, say the right, its own right must be refused, and hence, when it arrives on the enemy's line, the army will be in oblique order.

In order to make use of the oblique order with success, the enemy must be deceived as to the intention to attempt it, otherwise it may be in his power to frustrate its execution by reinforcing the menaced flank; extreme caution, therefore, in the preparation for such a manœuvre, and the utmost rapidity in its execution, are indispensably requisite.

The aim of using this order of battle is to turn or outflank the enemy.

**Observation, Army of**—A detached portion of an army, for instance, a *corps d'armée*, sent, either on the flanks or to the front, to watch the movements of an enemy who is believed to be bringing up reinforcements, and to keep him in check if necessary.

**Observatory**—A building erected for the purpose of taking astronomical observations, and furnished with the most approved instruments. In Europe, one of the first observatories was built by Tycho Brahe, a nobleman of Denmark, on the island of Huen, in 1576. The observatory of Paris was built in 1667, that of Greenwich in 1675. Public observatories are now maintained in almost every civilised country, and there are several private ones in England. From the daily observations which are made, and the means taken of publishing these observations, a great advance has been arrived at in astronomical science.

In different parts of India, and especially near Delhi, the ruins of large native observatories are to be seen, showing the great interest and, as we know, the intense study given by the natives of *India to the* sidereal world.

**Obstacles**—Impediments which render the approaches to positions or military works difficult to an enemy. They are of two kinds, *natural* and *artificial*. Natural obstacles are any positions that present advantages for defence, and prevent the approaching columns of the enemy from advancing or deploying. Mountains, rivers, defiles, swamps, fulfil these conditions. The effect of such impediments to the advance of an enemy is very great, and exercises a powerful influence on the operations of a war, and greatly complicates and increases the difficulty of carrying on a campaign.

Each country presents different forms of obstacles; in England, from the country being highly cultivated, the fences and the ditches separating arable from pasture lands would make it difficult for armies to find space to form front for battle.

A study of the topographical map of the country in which the operations of war are to be carried on will show what natural obstacles may present themselves, and how they can be made use of by the advancing army or by the enemy. The ignorance of such may often alter the plan of a battle, as was the case with the rivulet of Papelotte at Waterloo.

Of artificial obstacles, fortresses, bridges, bridge-heads, may be considered as the most important. Fortresses are generally built to replace rivers or mountains on a weak point of a line of frontier, and become of immense importance if a frontier already naturally strong has but few issues. The importance of bridge-heads is easily understood, as they may stop the passage of a river to an enemy.

*Artificial obstacles* of a minor nature are placed in the ditches of fieldworks, or in front of any position that requires being defended, with the view of checking and delaying the enemy under the fire of the work. Of such are abatis, palisades, stockades, trous-de-loup, chevaux-de-frise, harrows, crows' feet, fougasses, inundations. Broken wheels and bottles, long rough stones, &c. can be also used in cases of emergency.

**Obtuse Angle**, *vide* Angle, Obtuse.

**Occupation, Army of**—An army that remains in possession of a newly conquered country, retaining it as a kind of hostage, until peace is signed and the war indemnity paid. Armies of occupation are generally fed at the expense of the defeated nation.

**Off**—Most distant; a term commonly used in speaking of horses harnessed to a carriage, in contradistinction to *near*. It means the animal which is harnessed on the right hand facing the front of a team.

**Offence**—A crime committed by an officer or soldier for which he deserves punishment. All acts that are contrary to good order and discipline, omissions of duty, &c. may be called military offences, and subject the offender to be tried by court-martial. The principal offences are specified in the Articles of War.

**Offence, Guns of**—Generally heavy guns, that can be moved with an army, and which are used either as batteries of position or for siege operations, &c., because they combine long range with great accuracy and great destructive effect.

**Offensive in Battle**—To act on the *offensive* in battle means that an army comes into the field to attack an opposing force, instead of waiting to be attacked, and in contradistinction to the attitude of standing on the *defensive*. On the advantages and disadvantages of each position, 'The Artillerist's Manual' states as follows on the subject of battles:—

"If the fortune of war permit the general to choose between the offensive and the defensive, he ought, perhaps, under ordinary circumstances, to choose the latter; for the difficulties of the attack and the advantages of the defence have been undeniably increased by the introduction of breech-loading rifles. While the difficulties of the attack generally have been much increased, the special difficulties of a front attack have been so enormously increased that a general is amply justified by experience in conconcluding—(1) that, if he remains on the defensive, it is at least three to one that the enemy will merely make feigned attacks on his front, and will make the real attack on his flank; (2) that, if he takes the offensive, the chances of the success of a well-ordered flank attack are at least treble the chances of the success of a front attack.

"The moral is simple. Whether acting offensively or defensively, a general must have in hand a large body of troops specially intended to turn the enemy's flank, or to prevent the enemy from turning his own. The third division is reserved for this special service. By the defensive is meant an active, energetic defence."

**Offensive Warfare**, *vide* War.

**Offensive Weapons**—All arms of the present day, such as cannon, small-arms, swords, and other weapons which would be used on an army taking the field for offensive operations.

**Officer**—A person employed to perform any public duty. In a military sense, the name is applied to an officer in a regiment or department who exercises control or command, and executes authority under a commission from the sovereign. The name is also given to a person acting in a civil situation under government.

**Officer, Field**, *vide* Field Officer.

**Officers, Examination of**, *vide* Examination of Officers.

**Officers, Warrant**, *vide* Warrant Officers; also *vide* Conductors.

**Official Letters**, *vide* Correspondence, Military.

**Off-reckonings** — An allowance formerly given to the commanding officers of regiments and captains of companies, out of the annual clothing money set aside for their men. The allowance was subsequently paid only to the colonels of regiments, and was a fluctuating sum, depending on the amount of the surplus left after the clothing was made up. About twenty-five years ago, an average of thirty years was struck, and a fixed sum from that period allowed yearly to colonels, termed *colonel's allowance*, amounting to about £600 a year in line regiments, in addition to the regular pay. The term off-reckonings is therefore now obsolete.

**Off-sets**—In surveying, a perpendicular let fall from the stationary lines to the hedge, fence, or extremity of an inclosure.

**Ogee**—A moulding in architecture, partly concave and partly convex. Mouldings termed ogees are cast on smooth-bore guns and mortars, and are known in the former as the breech and *base ring ogees*, in the latter as the *reinforce* and *muzzle ogees.*

**Oil**—An unctuous liquid, the product of certain animal, vegetable, and mineral substances. For machinery, vegetable oils are chiefly used, especially *cocoa-nut oil*, which is extracted by expression from the cocoa-nut palm; *mustard* and *linseed oils* are used for the purposes described below. To obtain oil from the cocoa-nut, the nut is stripped of the husk or coir, the shell is broken, and the fatty lining inclosing the milk is taken out. In India, this substance is called *cobri*, *copra*, or *copperah*, according to the locality. Three maunds of *copperah* are thrown into a mill with about three gallons of water, and from this three maunds are produced, or seven gallons and three-quarters, of oil. Mustard and linseed oils are also extracted by expression, from the seeds of the plants bearing those names. The use to which these oils are put is very general.

Cocoa-nut oil is applied to the cleaning of machinery, elevating-screws of guns, parts of steam-engines, and various other metallic articles. It should never be used for the barrels of small-arms, as it contains an acid destructive to the interior of the barrel. Mustard oil is used in preparing hides, and by laboratory men, after working carcass composition, &c., for cleaning their hands; linseed oil, in making paint, and in mixing paint which has become thick from long keeping. There is also another oil used for paint, viz. that derived from the gurjun tree (*wood oil*), which is found in Indian arsenals, to answer better for painting on metal than any other, and is also used for painting case shot and other projectiles; it is very volatile, and dries rapidly even in wet weather, at which time common oils dry very slowly.

For the prevervation of small-arms from rust, *neat's foot oil* is used, and for gun-stocks, petroleum oil, known as *Price's Rangoon oil. Petroleum* is a rock oil, procured from great depths in the earth by means of wells. Its colour in its crude state is a dark green, but when refined and distilled, it is perfectly transparent. Burmah, Canada, and North America *produce* large quantities of this oil.

**Oil, Stone,** *vide* Stone Oil.

**Olympic Games**—Instituted by Hercules, A.M. 2856, in honour of Jupiter Olympus, at Olympia, a city of Elis, in the Peloponnesus. They were celebrated every four years. The design of these games was to accustom the young military men to all athletic and military exercises.

**Open Works,** *vide* Works.

**Opening of the Trenches** — Synonymous with breaking ground, or the commencement of the works of attack against a fortress.

**Operation, Lines of,** *vide* Lines of Operation.

**Operations, Base of,** *vide* Base of Operations.

**Operations, Military**—General movements of troops or armies in the field during mimic or real warfare. They are of two kinds, *strategical* and *tactical.* The former are undertaken before being within reach of the enemy, whilst the latter take place on the field of battle itself. (*Vide* Strategy and Tactics.)

**Operations, Siege,** *vide* Siege.

**Operations, Theatre of,** *vide* Theatre of War.

**Order**—An imperative injunction given by a superior to an inferior, which must be carried out without demur, and obeyed with readiness. To avoid their being misunderstood, orders, if verbal, should be given in most concise terms; if long and elaborate, they should be given in writing. Appeal may be made afterwards if not in accordance with the regulations or the recognised rules of the service.

A general, or any other responsible officer, may, however, judge whether orders sent by a distant authority are to be implicitly obeyed, if the circumstances under which they were given differ from those existing when the orders are received. The responsibility of dereliction is very great, but is often necessary for the success of a battle. Napoleon I. states on this subject that "Passive obedience is required to orders given by a superior on the spot, but not to those sent by one from a distance, not cognisant of existing circumstances." Military history affords many examples of such dereliction.

A general or other responsible officer

in the hands of the enemy loses the power of giving orders, and even should he attempt to send any, they would be considered null and void.

**Order of Battle**, *vide* Battle.

**Order of March**—The formation assumed by troops on the march, and which depends on the nature of the country they are moving in, the object to be attained, and the characteristic of the enemy, as well as the number of troops composing the force. If at any distance from the enemy, the comfort of the men, as well as the means of giving them the necessary supplies, must be studied. When in the proximity of the opposing force, tactical considerations must alone weigh in disposing of the order of march. In all cases an army is preceded by an advanced guard, followed by the main force, the rear of which is covered by a rear guard.

**Orderlies**—Soldiers told off in a regiment to officers in authority, either in a district, garrison, or regiment, for the purpose of carrying official messages and letters. Sometimes orderlies are mounted, when speed and urgency necessitate, and the distance will not permit of their duties being carried out on foot. These orderlies are furnished by mounted regiments.

**Orderly Room**—The court of the commanding officer, where charges brought against the men of his regiment are investigated, and sentence passed. It is also the office of the commanding officer, from which all orders emanate.

**Orders, Beating**, *vide* Beating Orders.

**Orders, Military**—Companies of knights instituted by kings and princes, either for the defence of the faith or to confer marks of honour on their military subjects. The most ancient and most celebrated of these orders is that of *St. John of Jerusalem*, which owes its origin to the Hospital of St. John, founded in Jerusalem in the year 1048. It became in 1118 a religious order of knighthood, and from 1309 the Knights were called *Knights Hospitallers of Rhodes*, and from 1530 *Knights of Malta*. The representative of this order in England was the Prior of Clerkenwell, who had a seat in parliament, and was styled *the First Baron* of England. This order is now almost extinct, no grand-master having been elected since 1805. The badge worn by all the knights is a Maltese cross, enamelled white and edged with gold, suspended to a black ribbon. Some members of this order did duty during the war of 1870–71 with the sick and wounded, the order thus appropriately ending, as it had begun, in hospitals.

The *Teutonic Order* is also one of the most celebrated of the religious and military orders to which the Crusades gave birth. It was founded in 1190 under the name of *Teutonic Order of St. Mary of Jerusalem*. Only Germans of noble birth were admitted, and they wore a white mantle with a black cross. This order began to decline in the fifteenth century, at the Reformation, when its members abandoned the papacy and embraced the Protestant religion. It was abolished by Napoleon in 1809, the lands passing to the sovereigns in whose dominions they lay. The Teutonic Order, however, still continues to preserve a titular existence in Austria, and its statutes were reorganised in 1840 and in 1865.

The *Order of the Knights Templars* also received its appellation from Jerusalem, and took its name from the convent being close to that of the Temple. It was founded in 1118 by Hugues de Paganes and other French knights. The whole order was in 1312 suppressed throughout Europe, and its property bestowed on the Knights of St. John. The habit of Templars was white, with a red cross of eight points of the Maltese form worn on the left shoulder.

The following are the principal military orders of Europe:—

| Country. | Order. | Instituted in |
|---|---|---|
| Austria | Golden Fleece | 1429 |
| „ | Elizabeth-Theresa | 1750 |
| „ | Maria-Theresa | 1759 |
| Baden | Charles-Frederick | 1807 |
| Bavaria | Maximilien-Joseph | 1806 |
| „ | Royal Order of Military Merit | 1866 |
| Belgium | Leopold | 1832 |
| Denmark | Elephant | 1693 |
| England | Garter | 1338 |
| „ | Bath | 1399 |

| Country. | Order. | Instituted in |
|---|---|---|
| England | St. Andrew or the Thistle | 1687 |
| " | St. Patrick | 1783 |
| " | St. Michael and St. George | 1818 |
| " | Star of India | 1861 |
| France | Legion of Honour | 1802 |
| Holland | William | 1815 |
| Italy | St. Maurice and St. Lazare | 1434 |
| " | Military Order of Savoy | 1831 |
| " | Iron Crown of Italy | 1868 |
| Prussia | Military Merit | 1665 |
| " | Black Eagle | 1701 |
| " | Iron Cross | 1813 |
| Russia | White Eagle | 1325 |
| " | St. Alexander-Newski | 1722 |
| " | St. George | 1769 |
| " | St. Wladimir | 1782 |
| Saxony | St. Henry | 1736 |
| Spain | Alcantara | 1156 |
| " | Calatrava | 1158 |
| " | St. Jacques de l'Épée | 1175 |
| " | Our Lady of Montesa | 1316 |
| " | Golden Fleece | 1429 |
| " | St. Ferdinand | 1811 |
| " | Ste. Herménégilde | 1814 |
| Sweden & Norway | Sword | 1522 |
| " | St. Olaf | 1847 |
| Turkey | Medjidié | 1852 |

**Orders, Regimental**—Such orders as are issued by the officer commanding a regiment for the information of the officers and regiment generally.

Regimental orders follow up all orders issued by the officer commanding the brigade, garrison, station, &c. having reference to the regiment.

**Ordnance**—By this term is understood in the British service any description of warlike stores; but its special signification, as used by the artillery, comprehends every gun, and every projectile fired from a gun; it also signifies a portion of the material forming a part of the equipment of that branch of the military service. Ordnance as applied to guns comprehends *smooth-bore* and *rifled*, *breech-loading* and *muzzle-loading*.

*Smooth-bore ordnance* comprise cast-iron and bronze guns, howitzers and *mortars*, ranging from 112 to 9 cwt. in *weight*. The best known guns are Bloomfield's, Dundas', Miller's, and Monck's. These guns are now nearly obsolete, and have been, for the most part, replaced by rifled guns.

*Rifled ordnance.*—Guns in which two or more spiral grooves are cut by the operation of rifling, so as to give the projectile a rotatory motion coinciding with the axis of the gun.

The object of rifling a gun is to remedy the many defects observed in the fire of projectiles discharged from smooth-bore cannon, which may be classed as follows:—

1. The shot not fitting tightly, which causes it to bound in its progress up the bore, and to take a direction either to the left or right after leaving the gun, according to the side of the barrel it struck before expulsion.

2. Windage, which leaves a considerable space between the upper surface of the bore and that of the shot, thus tending, on the explosion of the charge, to press the shot downwards into the under side of the barrel, known as the "seat of the shot," and to cause an indentation after much firing.

3. From the space alluded to between the upper surface of the shot and that of the barrel, the powder gas is enabled freely to pass and to act upon the barrel of the gun in that part so as to cause erosion (*q. v.*), and to prevent the full force of the powder acting on the shot.

4. An unequal rotation, from the causes mentioned, takes place in the flight of spherical projectiles, so that the true flight cannot be depended on.

5. The resistance of the air is greater to spherical projectiles of the same weight than to oblong shot.

With these defects it was natural that artillerists should seek for a remedy in order to counteract the varying tendencies observed in smooth-bores, and which could not be obviated as long as they were used. It occurred, therefore, as is stated in 'Chambers's Encyclopædia,' to all who sought to work out the improvements required, that this could best be managed by securing that the plane of rotation of the ball should be at right angles to its motion of translation, as the irregularities in the structure of a spherical shot, which produce the aberrations caused by a loosely fitting shot and a want of homogeneity, would thus act equally in all directions, producing an exact counterbalance, while the aberration from the ball's rotation would wholly disappear; and the constancy of the vertical transverse position of the plane of the ball's rotation was obtained by making one or more spiral grooves along the interior of the barrel.

The introduction of rifled guns into Europe, at least such guns as are used at the present day (for the invention of rifling barrels was known in Germany some centuries ago), was in 1846, when Major Cavalli and Baron Wahrendorff produced their breech-loading guns. Subsequently we find inventors in all countries (*vide* Gun), producing each his own mode of rifling, some of which have been adopted by the several continental powers. In England, in the year 1854, Mr. (now Sir W.) Armstrong's system of rifled guns, built up of wrought-iron coils, was adopted. His principle of construction, though modified, is still carried out in the manufacture of our ordnance; but his system of breech-loading has been superseded by a muzzle-loading gun, adapted to light and heavy artillery.

The advantages derived from rifled guns are as follows:—

1. Accuracy of fire. This is brought about by giving the projectile a rotation round an axis coincident with that of the bore.

2. By substituting elongated for spherical projectiles, increased range is obtained.

3. The facility of centring a shot, particularly in a B.L.R. gun, whereby greater accuracy of range and direction is obtained.

4. The velocity of the shot, from being elongated and the wind not so telling upon it, is kept up with less diminution of speed over the range it has to go than one of a spherical form.

5. In the penetrating power imparted to projectiles.

The pre-eminence of rifled guns over smooth-bores is established in all the armies of the world. Their penetrating power is enormous, as will be seen from the reports on rifled guns against armour-plating. The advantage was at one time in favour of the plates, but subsequent results of rifled practice show the superiority of the gun over armour. However, this may still be considered a moot point.

What is now known as the "Woolwich gun" (*q. v.*) is a modification of the French gun as regards the rifling, but resembles it in nothing else. All guns in the British service are now what is termed "built up."

The result of the trials and tests made with our muzzle-loading rifled guns proves them to be sound and durable, with great penetrative power and of vast range. There is a difference of opinion in the artillery world as to the advantages of muzzle-loading and breech-loading guns; each has its advocates. The next war in which England may be engaged may probably settle the question of the two systems. (*Vide* Appendix B.)

**Ordnance, Board of,** *vide* Board of Ordnance.

**Ordnance, Examination of,** *vide* Examination of Ordnance.

**Ordnance, Measurement of,** *vide* Measurement of Ordnance.

**Ordnance Select Committee**—A permanent committee of officers, with a secretary attached, for the consideration of all warlike inventions and other ordnance subjects. The committee sits at Woolwich, and carries out all proofs of ordnance, as directed by the minister of war. It decides and alters certain stores and *matériel* of the army, subject to the approval of the above named authority.

The proceedings of this committee are published quarterly.

Towards the close of the last century the work of testing new inventions was carried out by field officers of the corps of artillery, and in 1797 a committee of field officers, something similar to the present ordnance select committee, was then formed to consider and pronounce upon the inventions brought before it.

**Ordnance Survey,** *vide* Survey.

**Ordnance Survey Department**—A department of the British government in which the maps and plans of the whole kingdom and its parts are prepared.

**Ordnance, Surveyor-General of,** *vide* Control Department.

**Ord's Hose**—Used for firing mines; it acts as a waterproof leader, having instantaneous action.

**Organisation**—The act or process of

forming bodies of soldiers, and regulating the administration appertaining to them. Colonel Graham, in his 'Art of War,' says:—"Levies, when assembled, present only a confused mass, and are incapable of moving with order or regularity, or arranging themselves in a form suitable for a march or a battle, until they themselves have been divided and subdivided into regular proportions. One body must be formed out of the elements which have been brought together, all the members of which may be instantly put in motion by an impulse communicated from the head, so as to execute the service required. This is called the organisation of an army.

"The necessity of this organisation must have suggested itself the moment the first levies were collected. Order, discipline, and the power of adapting the disposition of forces to places and circumstances, were the result of the mechanism thus introduced, the mainspring of which is the chain of responsibility from the general down to the commander of the smallest subdivision."

"An organised body of troops," says Sir J. Burgoyne, "amenable to the laws of discipline, accustomed to act together, mutually reliant, trained to perform in unison the movements best suited to the march and the battle, is more formidable than an assemblage, however numerous and however skilful in the use of their weapons, but in whom the concerted action is wanting."

The organisation of an army is the duty of the general staff in time of peace, and, unless thoroughly prepared beforehand in its most minute details, will break down on the eventuality of a war, as was proved during the war of 1870–71. France was beaten because she was not ready, and her armies may be said to have been defeated before a shot was fired, her organisation being so inferior to that of the Germans.

Jomini lays down the following general conditions, as essential to the perfect organisation of an army:—

1. A good system of recruiting.
2. An efficient formation.
3. A well organised system of national reserves.
4. That officers should be well instructed in drill and manœuvres, and in all the duties of a camp and in the field, and that there should be a good system of interior economy.
5. A discipline strict, but not humiliating; a spirit of subordination as far as possible on a conviction pervading all ranks of its importance, rather than on the mere orders of the service.
6. A well regulated system of rewards and a spirit of emulation.
7. A special corps, engineers and artillery, well instructed.
8. An armament well understood, and, if possible, superior to that of the enemy, comprising arms defensive as well as offensive.
9. A staff capable of applying all these elements to the greatest advantages, and with an organisation adapted to the theoretical and practical instruction of its members.
10. Well organised commissariat and medical departments.
11. The command of armies and the supreme direction of operations by a sound practical system.
12. The maintenance of a high military spirit.

**Orgues** (French = organ)—In fortification, long and thick pieces of wood shod with iron, each suspended by a separate piece of rope over a gate, so as to close it up upon the approach of an enemy.

The word *orgue* is given to an ancient piece of ordnance, composed of a number of musket barrels, so joined on the same carriage, and the touch-holes corresponding with each other, that they can be discharged simultaneously. This weapon may be said to be the origin of the *mitrailleuse*.

**Orillon**—In fortification, the circular part of the flank towards the shoulder of a bastion, which serves to cover the rest of the flank.

**Orpiment**—A sulphuret of arsenic. There are many varieties of orpiment, one in fine golden coloured scales, another in dense yellow stony lumps, a third in earthy-looking masses, called *king's yellow*, a familiar paint; but the orpiment required in the laboratory for blue lights, signal lights, and parachute light-balls, is the *red proto-sulphuret* or realgar.

**Oscillating Engines** — Engines in which the cylinders *oscillate* upon hollow axes or trunnions, through which the steam is admitted to and withdrawn from the cylinders; the piston-rod by this means accommodates itself to the motion of the crank, without the parallel motion being required.

**Oscillating Screw,** *vide* Screw, Oscillating.

**Oscillation** (Latin, *oscillo,* I swing)—Is described as "the motion which a pendulum undergoes when moved by any force, and which is indicated by the centre of gravity describing alternately a circular arc on the one side or the other of its position of rest. If there were neither friction nor atmospheric resistance, this motion of vibration or oscillation, on either side of the position of equilibrium, would continue for ever, but in consequence of these resistances, the distance to which the pendulum swings decreases more and more with every swing, until it comes to rest."

"The *centre of oscillation* is that point in a body vibrating about a horizontal axis in which, if the whole mass of the body be supposed collected, the period of oscillation will be the same as before."

**Outfit Allowance**—A sum of money given to a cavalry or infantry non-commissioned officer who succeeds in getting his commission from the ranks. £150 is given to the former, and £100 to the latter. In giving the cavalry man the additional sum of £50, it is to enable him to purchase his charger.

**Outflank, To**—To turn the flank or flanks of an army. (*Vide* Flank Movement.)

**Out-lying Picket,** *vide* Pickets.

**Outposts** — Bodies of troops, chiefly cavalry and infantry, posted beyond the bound or limits of the encampment, to give an army or detachment timely notice of the movements of the enemy, and to guard against surprises. "Like advanced guards," as Colonel Hamley shows in his 'Operations of War,' "they must be placed at a distance from the main body which will fulfil this purpose, without exposing them to be cut off or overpowered; and as they occupy much ground in proportion to their force, 3 miles is as great a space as should *intervene between them* and the army." The advanced guard usually supplies the outposts, and the mode of disposing of them depends on the ground taken up by the main force.

Artillery is employed on outpost duties only on special occasions, when it is important to hold certain points, such as defiles, bridges, causeways, &c., and is usually attached to the reserve. When attached to outposts stationed in a defile, the guns are unlimbered and are prepared for action; in all other cases they remain limbered up, as near to the main road as possible, and *never in an inclosed space.* If it be intended to defend any particular position in advance of the reserve, emplacements should be made for the number of guns to be employed, but they should not be permanently occupied. In short, the rule is that artillery is only brought on outpost duty where a favourable opportunity for its employment presents itself; when required for the defence of a position, the guns must not be detached, but be held in readiness to take their place in a work which has been prepared for their reception.

Officers commanding outposts should make themselves thoroughly acquainted with the locality in which they are placed, by carefully examining the post, the heights within musket shot, the roads and paths leading to or near the post, ascertaining their breadth and practicability for cavalry or artillery, in order to insure a constant and ready communication with the adjoining posts and vedettes. The hollows which may cover the enemy's approach should be examined, and all points considered with reference to the possibility of an attack.

Colonel Macdougall, in his 'Theory of War,' explains the object of an outpost as follows:—"The safety of an army in an enemy's country materially depends on the manner in which the outpost duty is performed. The outposts, pickets, and advanced sentries, are the watch-dogs of the army, whose peculiar business is to detect and give timely warning of the approach of an enemy, as well as every circumstance which may appear to threaten its safety. An officer in command of an outpost should invariably act as if the safety of the whole army depended on his individual vigilance, and he should impress the same feeling of responsibility on the mind of every one of his sentries."

From the foregoing it will be seen that the task of an officer engaged in the duty of commanding an outpost is not only dangerous and arduous, but demands prudence and coolness, as he has to act upon his own speedily formed judgment; to waver or hesitate is to be lost. His position requires attention, endurance, and, above all, discernment. He must secure the troops from a surprise, and to inform himself and report as to the enemy's movements. Constantly visiting the chain of sentries, and ready to examine all those who pass through the lines, no time is allowed to him for sleep, and in case of attack he has to hold the enemy in check, till the main body has time to take up a position and to deploy.

The average strength of outposts should be about one-fifth of the force to be protected.

**Outrance** (French)—To the utmost; to the last extremity. Thus the French say, *se battre à outrance*, to fight to the last extremity.

**Outworks**—In fortification, are the works constructed beyond the enceinte or body of the place and within the glacis, such as ravelins, tenaille, horn and crown works, counter-guards, lunettes, covered ways, &c.

**Oven**—An apparatus for baking, and cooking soldiers' food. In the army, the ovens for baking the soldiers' bread are of two kinds, *steam* and *field* (dependent on the nature of the service). The former is mounted on a carriage, and can be drawn by a pair of horses. Ovens of this kind will bake in each batch on an average 109 loaves of 3 lbs. or 2 field rations each. The latter (Aldershot pattern) can bake 100 rations (150 lbs.) at a time.

Travelling bakery wagons are also now approved for the use of the army service corps. The wagons are covered, and in them the bakers can knead and prepare the bread for the ovens.

For cooking purposes, ovens of various kinds have been invented; amongst others, those by Captain Grant, both for barrack use and in the field, and Soyer's cooking stoves, which were used in the Crimea.

**Oxidation**—The conversion of metal surfaces into rust, by their combination with a certain portion of oxygen.

**Oxide of Calcium**, *vide* Lime.

**Oxide of Iron**—Results from the combination of iron with oxygen, in sufficiently large quantities to cause it to lose its metallic state.

**Oxygen** (symbol, O; eq. 8; sp. gr. 1·1057)—One of the elements widely diffused throughout nature, but which is never found in a pure isolated form. In the atmosphere, it is mechanically mixed with nitrogen; in water, it is chemically combined with hydrogen. Oxygen was discovered by Priestley in August 1774, and one year later by Scheele, who was then unware of Priestley's discovery. Eighty-nine per cent. (by weight) of water consists of oxygen; atmospheric air contains 23 per cent. of the same element, which also exists in combination with most of the other elements in various proportions.

## P.

**Pace**—The rate at which a man or animal moves, either at the walk, trot, or gallop. The usual length of a man's pace is about 30 inches for ordinary marching, and 3 feet for the double, but the soldier is trained to increase his pace as required. A horse walks at the rate of 328 feet in a minute, or nearly 3¾ miles an hour; trots 656 feet in a minute, or nearly 7½ miles an hour; and gallops 1056 feet in a minute, or 12 miles an hour.

**Pack Saddle**, *vide* Saddle.

**Pack Thread**—A coarse thread or string used for sewing up and securing packages.

**Package**—This term is applied to the wrapper or packing cloth round stores in transit, or whatever constitutes the covering of stores for their preservation.

**Package of Ammunition** — In the artillery service, this is carried out in boxes of a sanctioned pattern, and the ammunition, shot, or shell, is secured in compartments or in some other way most convenient or suitable. The boxes are carried on ammunition wagons, which escort the gun.

Small-arm ammunition is packed in boxes, and carried on a campaign in special wagons made for the purpose.

**Packing Box**—A box used for keeping fixed shot or shell in store, or in transit from place to place, or on the march with siege trains. The name is given to any box or case containing military stores.

**Paddling**—The removal, by means of a copper spud, of such lumps of gunpowder as adhere to the faces of the rollers during the incorporating process in the manufacture of gunpowder. The operation requires great care, and should only be resorted to under exceptional circumstances. Generally water poured on the face of a roller will, to some extent, loosen the powder.

**Padlock**—A lock hung on a staple. The pattern padlock used as the fastening of artillery ammunition boxes is a spring lock with key.

**Pads**—In the artillery and cavalry service, are used to protect saddle and draught horses from galls. The pad recommended is in the form of a folded blanket, or pad made of sheep or kid's skin, stuffed with hair, 6 inches by 4 inches. When placed above and below the gall, considerable relief will be afforded.

In 'Short Notes on Field Batteries,' the following remedies for gall wounds are recommended:—

"If a piece of harness is seen to be commencing to rub a horse, besides altering the fitting, friction may be prevented by rubbing in any lubricant (tallow will do on an emergency).

"To cure a gall or sore while the horse continues his work, pads must be judiciously applied. Sheep skin is the favourite specific of many collar-makers; it sometimes effects more than would be expected: it enables the harness and skin side of the sheep skin to move, while the ends of the hair remain without motion on the tender part of the horse. The rubbing of a trace is sometimes difficult to prevent; I have seen the pressure completely removed by attaching a short flat piece of wood along a hip or bearing strap, with the ends extending 2 inches past the trace, small pads being fixed on it above and below the trace. It looks ugly, but it works well."

Elastic pads constructed of a certain number of tubes of vulcanised caoutchouc united together, and invented, some years ago, by General Angelini, of the Italian army, are stated to have been very successful in the Italian cavalry in preventing galls.

**Paint**—A kind of paste made by mixing white-lead, turpentine, and linseed oil together; other substances are used, such as colouring matters or "stainers," drying materials or "dryers," &c., but white-lead is the basis of all ordinary paints, and forms at least $\frac{9}{10}$ of their composition. The turpentine used in paint has the property of dissolving fatty and resinous substances. On exposure to the air, it absorbs oxygen and hardens; this renders it suitable as an ingredient.

Linseed oil also takes up oxygen on exposure to the air and hardens; from this quality it is known as a drying oil. Its drying powers are much increased by boiling it along with litharge (red-lead) or binoxide of manganese. After this process it is known as boiled oil.

From the above properties, it will be seen that paint, when mixed, will soon become unserviceable if exposed to the air. It is not desirable, therefore, to mix paint long before it is wanted for use; even in closed tins it is apt to spoil.

A great variety of paints are used for different purposes, such as the painting of gun carriages, shot and shell, and other military stores. It is unnecessary, however, to go into detail on their manufacture or use, as each arsenal or military establishment has its own instructions how to make and apply them.

**Paint, Anticorrosion**—A paint formerly used as a lacquer for the exterior of iron guns, for cast-iron garrison carriages, war rockets, and very generally on all iron work which is exposed. It has been superseded by Pulford's magnetic paint (*q. v.*).

**Pairing**—A name given to one of the processes employed in basket-work, in making brushwood gabions.

**Paixhan's Gun** — A muzzle-loading shell gun or howitzer, introduced many years ago into the French and Russian navies by a French general of that name. Loaded shells, with time fuzes, were the projectiles fired from this piece. The destruction of the Turkish fleet at Sinope was caused by these guns.

**Palisade** (French, *palissade*)—A barrier made of wooden posts firmly set in the ground. In fortification palisades form one of the auxiliary means of defence in permanent and field works; in the former, they are usually planted in the covert way; and in the latter, in the ditch of the work. Where there is a covert way, palisading becomes indispensable, and the palisades are usually fixed on the banquette, about 1 foot from the glacis, and standing about 1 foot above the crest. For permanent works they are constructed of timber sawn into lengths of 8 or 10 feet long, and 8 inches and 4½ inches square, depending on the size of the timber. Palisades for fieldworks are seldom made of timber sawn into scantling, but are constructed of unhewn timber of trees suited to the purpose, planted firmly in the ground, and connected above with a riband, into which the palisades are spiked. The position of palisades for the security of field fortifications should be under musketry fire from the parapet, or flanking works, so as to command the ditch.

**Palliser's Guns**—These guns bear the name of an officer of cavalry, who has devoted much of his time and resources to the subject of artillery, and is the originator of a method of strengthening cast-iron guns with internal tubes of wrought iron which are rifled.

The object of the conversion is to utilise old cast-iron guns for general service. The result has been most satisfactory, showing that such guns are capable of a greater amount of endurance than before they were re-lined; and that, as shell guns, they are well adapted for use against wooden ships, or the land fronts *of forts*. The guns which have been *converted* are the 8-inch of 65 cwt. and 32-prs. of 58 and 56 cwt. into 64-pr. R.M.L. guns of different weights, and the 68-pr. of 95 cwt. into an 80-pr. rifled gun of 5 tons. (*Vide* Appendix B.)

This officer's name is well-known to artillerists as the inventor of the chilled shot (*q. v.*).

**Pan Coupé** — In fortification, the salient angle of a place-at-arms, filled up to form a short face or a curve for musketry fire on the salient, or for one or two guns placed *en barbette*.

**Panic** (Greek, *panikos*, groundless fear) —A sudden and groundless alarm which is known to seize upon men's fancies without any visible cause. The word traces its origin from the mythical story of the god Pan, who is stated, during the Indian expedition of Bacchus, to have been surrounded by enemies, and that the shouting of his men, favoured by the echoes of a rocky valley, so frightened them that they instantly took to flight, and hence it came to pass that all sudden fears impressed upon men's spirits, without any just reason, were by the Greeks and Romans called *panic terrors*.

**Panniers** (French, *panier*, basket)—Light baskets for carrying medical stores or signalling stores. They are carried on pack animals, either on mules or camels. Panniers, in the case of a mountain campaign, are provided for carrying rockets. In fact, all kinds of light baskets capable of holding stores, and which are swung across a pack animal, are called panniers.

**Pantograph** (Greek, *pan*, all; *grapho*, I write)—An instrument for copying drawings on a larger or smaller scale than the original.

**Pantometer** (Greek, *pan*, all; *metron*, measure)—An instrument for measuring all sorts of angles, elevations, and distances.

**Paper** —A thin and flexible substance, usually made of vegetable fibre, such as the pulp of linen, cotton rags, &c., and which is used for writing, printing, drawing, and other purposes. The following table contains the names and dimensions of many of the writing and drawing papers in use :—

| | Inches. | | Inches. |
|---|---|---|---|
| Antiquarian .. .. | 52½ | by | 30½ |
| Double elephant .. | 39½ | „ | 26½ |
| Atlas .. .. | 33 | „ | 26 |

| | Inches. | | Inches. |
|---|---|---|---|
| Columbian .. .. | 34½ | by | 23 |
| Elephant .. .. | 28 | „ | 23 |
| Imperial .. .. | 29½ | „ | 21½ |
| Super-royal .. .. | 27¼ | „ | 19¼ |
| Royal .. .. | 23½ | „ | 19 |
| Medium .. .. | 22¼ | „ | 17¼ |
| Demy .. .. | 19½ | „ | 15¼ |
| Foolscap .. .. | 16½ | „ | 13¼ |

Drawing papers are not made smaller than demy. Writing papers are not made larger than double elephant, and seldom larger than imperial.

A very useful paper is *tracing paper*, which is rendered transparent by brushing it over with a mixture of Canada balsam and oil of turpentine, or nut-oil and turpentine. It is used for taking a trace of any plan or drawing.

**Paper, Bibulous,** *vide* Bibulous Paper.

**Paper, Portfire**—A coarse kind of brown paper, used for portfire and signal rocket cases, and for rough reports and returns, as are usually made out in the artillery park and batteries.

**Papier-mâché** (French = chewed paper) —A substance made from the pulp of paper which has been ground up with other materials. It is susceptible of being moulded into any shape or form. In the artillery service, it is used in the manufacture of wads for fuze holes, &c.

**Papyrography** (Greek, *papyros*, a plant from which paper was first made; *grapho*, I write)—A term given by Captain Abney, in a lecture before the British Association for the Advancement of Science, at Belfast, in 1874, to a modified process of photolithography for enlarging copies of maps, which he considered to possess certain advantages for use in the field. The process is carried out by means of an ink invented by Captain Abney, which is not greasy, and drawings made with which upon ordinary paper might be transferred to stone or zinc, for the reproduction of topographical maps and military sketches.

This invention has been introduced into the British army.

**Parabola**—The curve described by a body which is under the influence of an impulsive force and gravity only.

It is also thus described:—“One of the conic sections formed by the intersection of a plane and a *cone when the* plane passes parallel to the side of the cone.”

**Parabolic Theory**—In gunnery, has reference to the laws which govern the flight of a projectile in vacuo. The deductions from this theory were in the very early days of artillery science considered to be applicable to a projectile fired in a resisting medium, but it is now well known that it is valueless in practice, except when the initial velocities of projectiles are less than 200 or 300 feet per second, and when the resistance of the air is very small.

**Parachute Light**—A suspended light, invented by Colonel (now General) Boxer, R.A., and which is used for the same purpose as *ground light-balls* (*q. v.*), viz. to light up the enemy's works and working parties. It is preferred to light-balls, as they can be extinguished or their lights hid with a few shovelfuls of earth, whereas the parachute has the advantage of being out of reach, so cannot be interfered with.

The *parachute light*, as described in the ‘Treatise on Ammunition, 1874,’ “consists of two outer and two inner tinned iron hemispheres; the two outer are lightly riveted together, the two upper hemispheres are connected by a chain; the inner upper hemisphere has a depression at the top, to admit the bursting charge and fuze. A quick-match leader conducts the flash from the bursting charge to the fuze composition in the lower inner hemisphere. The inner upper hemisphere contains the parachute tightly folded up. To insure its opening, a cord is passed between its folds, and through a hole in the top of the parachute, and is fastened to the upper inner hemisphere, so that, when the hemisphere is blown away, the cord is pulled through, and the parachute expanded.

“The lower inner hemisphere contains the composition. A hole is bored, and driven with fuze composition, and matched as usual; this hemisphere is connected with the parachute by cords and chains.

“The bursting charge is issued in the parachute, the fuze is bored to the required length and well hammered in; the parachute placed in the mortar and fired.”

The action is further described as follows:—The fuze ignites the bursting charge, the outer hemispheres are blown away, and the inner upper hemisphere, which is chained to the outer one, is blown away with it; the parachute is opened by the cord and expands, the composition in the lower hemisphere being ignited by the quick-match leader, which ignites the fuze composition, the composition burning about three minutes when fired from the 10-inch mortar.

**Parade**—Any place where troops assemble for muster, inspection, drill, &c.

Parades are distinguished as follows:—

*General parade*, where all the troops of a garrison draw up.

*Regimental parade*, where a single regiment is formed under the inspection of the officer commanding the regiment.

*Private parade*, where officers commanding troops or companies inspect their men previous to joining the regimental parade.

In camps the parade-grounds are usually in front of the line of tents.

**Parade, To**—Signifies the act of drawing up a body of men, in view to their being inspected.

**Parado**—In fortification, a traverse made to give protection from splinters, or fire from the rear, as well as to cover powder magazines and part of the garrison.

**Parallax**—A change of apparent position of any celestial object, or the difference between the true and apparent place of the heavenly bodies.

**Parallel Motion**—A simple and beautiful arrangement of linkwork, invented by the celebrated Watt, to convert the reciprocating circular motion of the extremity of the great beam of the steam-engine into a reciprocating rectilinear motion adapted to the piston-rod.

**Parallels**—During a siege, deep trenches formed to connect the several approaches carried on before a besieged place.

In commencing the attack of a fortress, the besieger is careful to make his *first parallel* at such a distance as shall prevent the fire of the place or the musketry fire of sorties disturbing his working parties, and at the same time not too far away from the place invested, as the greater the distance of the parallel, the greater will be the length of the approaches leading from it to the place. The change from smooth-bores to rifled guns has affected the distance at which the first parallel was formerly opened. The *second parallel* is formed when the approaches have been extended halfway from the first parallel to the fortress; the *third parallel*, when the approaches arrive within 120 yards of the salients of the covered way.

In a note given in the 'R. M. A. Instruction Book on Fortification, &c.' the following is stated on the subject of the "first parallel":—"The experience of the war of 1870–71 seems to show that, if the besieger's first batteries are, by reason of the power of his guns, placed at distances of from 2000 to 4000 yards from the fortress, the ordinary 'first parallel' may be dispensed with, that is to say, the ground in front of these distant batteries would at the commencement of the siege be occupied by rifle-pits and military posts rather, perhaps, than by continuous trenches. Afterwards, no doubt, a continuous trench would have to be constructed to protect the approaches and gain ground, though not to cover the first batteries, and this trench might be called the 'first parallel,' though not the first protective or defensive work undertaken."

After this, while the approaches are being made from the *third parallel* towards the two ravelins, a double sap may be pushed forward on the capital of the bastion, and a *fourth parallel* constructed to connect it with the trench cavaliers, as well as to support the lodgments on the glacis. Lastly, a *fifth parallel* should be commenced, so as to protect the lodgments on each flank of the attack, which lodgments are then converted into batteries of 5 guns each to breach the ravelins. (*Vide* Siege.)

**Parallels of Latitude**—Small circles supposed to be drawn on the surface of the earth, north and south of the equator, and parallel to it, dividing the globe into two unequal parts. Parallels of declination are such circles produced in the heavens, north and south of the equinoctial, and parallel to it.

**Parapet** (Italian, *parapetto*, breastwork)—In a permanent work, the parapet is described as "the covering shot-proof mass on the exterior side of the rampart. In fieldworks, it is a mass of earth thrown up as a protection against an enemy's progress; the ditch from which the earth is excavated forming an additional impediment. The parapet should always be of sufficient height to screen the defenders from the view of the enemy, and, therefore, on level ground, the height must be nearly 8 feet. But if a work be intended merely to cover a guard, or to hold out against a sudden assault, a parapet of 6 feet high will, in many cases, be sufficient. The thickness should vary in proportion to the calibre of the projectile which the parapet is intended to resist."

**Parbuckle, To**—In artillery exercise, to roll a gun, so as to cause it to move in either direction from the spot on which it rests. For this purpose, the gun must be placed on skids; and if it is to be moved up or down a slope, two 4½-inch ropes must be made fast to some suitable object on the upper part of the slope, and the ends carried under the chase and breech of the gun respectively, round it and up the slope. If the running ends of these ropes are hauled upon, the gun ascends; if eased off, it descends. If the ground is horizontal, handspikes only are necessary to move the gun. If the slope is not great, one rope will suffice to parbuckle a gun up with. In this case, it must be made fast to one of the trunnions, and passed as many times round the gun in rear of and close to them as may be convenient, the running end coming out as before over the gun and up the slope. In hauling the gun up, the rope uncoils itself. The breech end of the gun, on account of its greater thickness, will always advance quicker than the muzzle.

**Parchment**—The dressed skin of an animal; it is used for legal and other documents. Soldier's final discharge certificates are made out on parchment. The flesh of drums is also made of parchment.

**Pare, To**—In carpentry, to cut or trim the surface of a plank with an adze. In farriery, the expression means to cut or pare down the hoof of a horse in order to fit the shoe.

**Park**—An inclosure, or any place where guns, wagons, carts, &c. can be placed in safety.

A *park of artillery*, in the field, signifies the whole train of artillery forming the guns, ammunition, carts, wagons, and stores required for a siege or other purposes, as well as the reserve of gun and small-arm ammunition for the army. The term is applied also to the ground on which all guns stand or are parked.

During a siege the park must be sheltered and screened as much as possible from the view and fire of the enemy, but in a position to communicate freely with the besieger's trenches. If possible, its locality should also be chosen close to some good line of communication, either a road or river. Great thought should be given to the position of the laboratories; they should be farthest away in the park from the enemy.

The officer in charge of a park is assisted by well trained men of the ordnance branch, and a large number of artificers of various trades are attached to the park.

An *engineer park* comprehends all the material, tools, &c. attached to that branch of the service.

*A siege park* comprises the guns collected together at the commencement of the investment of a fortress, taken from the artillery park and manned by artillerymen, aided by men of the ordnance department. (*Vide* Siege Train.)

**Park, To**—To lodge, to place anything in a safe and convenient manner; to inclose. This expression is applied in military matters to the parking of the artillery, cattle, &c., whence the expression, "the artillery was parked in the fields."

**Parkinsonia**—A shrub found commonly in Bengal. It has been stated to yield a very fair charcoal for gunpowder purposes; but from trials made of it, of late years, at the government powder works at Ishapore, it was not found to be equal to that made from *urhur* or *dhall stalk*. Nevertheless it might be used if the latter crop failed.

**Parley**—Oral treaty; conference.

**Parley, To**—In a military sense, means to enter into conference with the enemy. This is done by means of a flag of truce.

**Parole**—A word published in orders every day, by the officer in command of a garrison, for the purpose of distinguishing friends from foes, and without the knowledge of which no one can approach or pass by a sentry's post. It is also the pass-word or order transmitted from front to rear of an army, by word of mouth. Also the word of an officer under confinement as a prisoner in an enemy's camp or country, who is allowed to be at large, having promised not to effect his escape. An officer in the hands of the enemy may even be permitted to proceed to his country *on parole*, having previously promised not to take up arms again against his captors until the war is over.

**Parrott Gun**—A rifled gun, the invention of Mr. R. P. Parrott, an American. The cannon proper is a cast-iron gun of very light proportions, rifled with fine grooves, the circumference of the bore being equally divided between the lands and the grooves. Three calibres were introduced into the U.S. service, viz. 10-prs., 20-prs. and 30-prs. The projectile used with these guns is an elongated shell, of a length equal to 3 calibres, and cylindro-conical in form.

**Parson's Gun,** *vide* Converted Gun.

**Partisan**—A leader of a detached body of light troops who, knowing the country in which the operations of war are carried on, is employed either in obtaining intelligence or harassing the enemy, by falling on his rear, attacking his convoys, and destroying his line of communications. *Guerillas* during the peninsular campaigns, and *franc-tireurs* (*q.v.*) during the war of 1870–71, carried on partisan warfare.

**Partizan**—A kind of pike introduced in the reign of Henry VIII. It is stated that it was found more useful than the actual pike in making trenches, and in attacking and defending lodgments. This arm continued in use during Elizabeth's reign.

**Party**—As applied to military matters, expresses any small number of soldiers detached from an army or regiment on any particular duty either in peace or war time. A party is often sent out to forage, reconnoitre, and gain intelligence. The term is applied also to other duties which small bodies of men are engaged on, such as *recruiting parties*, *working parties*, *storming parties*, and *firing parties*. The three former will be found under their own heads. *Firing parties* are men selected to fire over the grave of any one buried with military honours.

**Pass**—In military life, a "pass" is simply the permission granted by the officer commanding a regiment to a soldier to be absent from his quarters, recorded and signed by the commanding officer, so that the soldier may be able to show to others, if necessary, the authority for his being absent from his regiment. The Queen's Regulations lay down the rules on the subject of granting passes.

**Pass, Mountain**—A road or path leading from one side of a mountain to another. In latitudes where much snow falls, the "passes" are only open for egress or ingress during the summer months. In warfare, mountain passes play a very important part, if the operations, whether defensive or offensive, are carried on in a mountainous country. (*Vide* Mountains.)

**Passage Warrant**—One among the numerous royal warrants issued for the guidance of the army. It relates, as its name implies, to the rules and regulations to be observed in applying for passages on board troop and other government ships. The accommodation granted to officers, and the quantity of baggage allowed, as well as messing costs, will be found in the copy of this warrant. (*Vide* Appendix N.)

**Paste**—A tenacious mixture of flour and alum in the proportion of 2 lbs. of flour to 1 oz. of pounded alum mixed with 1 gallon of boiling water. The mode of preparing it is as follows. Heat it gently, stir it, and let it boil ¾ of an hour; when it becomes ropy, pour it into bowls, and pass it through a sieve before it is quite cold. It should be used cold, and only 2 or 3 days' supply made at a time, but it may be preserved longer by adding alum in the proportion of one-tenth the weight of flour. Paste is used in the laboratory in case-making, for portfires, rockets, light-balls, &c.

**Pastern**—The part of a horse's foot from the fetlock to the heel.

**Patch,** *vide* Dispart.

**Path**—In gunnery, the direction of a projectile in its flight; also termed the trajectory (*q. v.*).

**Patrick, St., Order of,** *vide* St. Patrick, Order of.

**Patrol** (French, *patrouille*)—A party told off from the main or regimental guard for the purpose of quelling disturbances, picking up stragglers, or any such duty as may be required of it in garrison or camp. Also bodies of men moving between the line of posts to keep the one informed of the state of the other are termed "patrols."

**Paul**—The name given to a sepoys' tent. It is of a different pattern to the European soldiers' tent, being much smaller and lighter.

**Pauldroons**—In ancient armour, plates of metal for the protection of the shoulders.

**Paulins**—Canvas cloth, either waxed over or tarred, for the protection of stores. The former are not used for home stores, but are found in Indian arsenals. They are of four sizes, viz.:—

Magazine, large;
Magazine, small;
Camel paulins;
Cart paulins.

*Large paulins* are used on the floors of laboratory tents. *Small magazine paulins* are used in covering powder barrels and live shells in the batteries. *Camel paulins*, being of a small size, are frequently very convenient, and are used for the same purposes as small magazine paulins. *Cart paulins* are used with tilts for artificers' carts. With the exception of the camel and cart paulins, which are made of coarse country canvas, all others are made of vitry.

*Tarpaulins* are of different size, and are used in England and the colonies, but not commonly in India.

**Pavise**—A heart-shaped shield used in the fifteenth century, and hanging on the backs of arbalisters. This shield was carried in action by a *pavisier*, whose duty it was to ward off from the bowmen the missiles of the enemy.

**Pawl**—A catch which holds in a ratchet and restrains a capstan or windlass from flying round in a reverse direction during any pause in the winding.

**Pay**—Compensation given or a return made in money for services done, such as the pay given to officers and soldiers. Pay is distributed once a month to officers, and weekly to men in the ranks.

The salary of officers and men in the army differs according to rank. Troops began to be in the pay of the government after 1660.

Deprivation of pay can be awarded, as a punishment to soldiers, for such offences as are not of sufficiently serious nature to be brought before a court-martial. (*Vide* Appendix O.)

**Pay Abstract**—A form of document in which the pay of a company or regiment is drawn, and the establishments attached to a regiment.

**Pay, Deferred**—An increase of 2d. per diem granted by parliament to the non-commissioned officers and soldiers of the army and army reserve, under the following conditions:—

"The 2d. per diem for the army with the colours, to be payable on the discharge or death of every non-commissioned officer or man, in respect of all service (previously to the completion of 12 years' service) from April 1, 1876. The 2d. per diem for the army reserve, to be paid annually in arrear to all men in it. Any sum earned by a man, dying during the year, to be paid to his representatives. £1 per man, now paid for necessaries, not to be payable to men accepting the new terms."

**Pay Department,** *vide* Control Department.

**Pay, Good-conduct,** *vide* Good-conduct Pay.

**Pay, Half,** *vide* Half-pay.

**Pay, Staff,** *vide* Staff Pay.

**Paymaster**—An officer of the army attached to each infantry and cavalry regiment, and to brigades of artillery other than those in India. His duties are confined to paying the officers and men of the regiment, and keeping a strict account of all money passing through his hands, a statement of which he has to submit, in England, to the accountant-general, and in India to the examiner of accounts. Advances in India are made monthly or oftener from the nearest district paymaster. The pay of the artillery in India is disbursed by the commanding officers of batteries. A paymaster, on joining his regiment, has the relative rank of captain, and his pay and rank are improved from length of service.

There are also *control paymasters*, who are not in any way connected with regimental paymasters. They pay the staff, contractors' bills, &c., and render their accounts to the War Office.

**Paymaster-Sergeant,** *vide* Sergeant.

**Peace**—Rest, quietness; direct opposition to war; the result and ultimate object of any contest.

**Peace Establishment**—The reduced number of effective men of an army during peace time; regiments are raised to their full complement in war time, or, as it is termed, to a *war establishment*. In Great Britain the raising of the army from a peace to a war establishment is effected by calling out the reserve, the militia, enrolled pensioners, and volunteers; in continental armies, where the compulsory service is in force, by calling out the men on furlough and the reserves.

**Pearl-ash**—Impure carbonate of potash, called in Hindustani *sáji mutti.* It is used for removing paint or grease.

**Pebble Powder** — A large-grained powder which is used with heavy guns. It receives its name from the grains being originally broken up into lumps resembling the size of small pebbles. The grains are now cut into cubes of about ½ inch, but the size depends upon the size of the gun from which this nature of powder is fired. Experiments which have lately been made tend towards using a larger grain than the above with the 38-ton gun. Experience has shown that a grain of 1½-inch cube with this nature of powder is the most suitable for the above gun. In the proof of the 81-ton gun, cubes of powder from 1·7 to 2 inches were used with great success, the pressure being within permissible bounds, and not exceeding 25 tons to the square inch. This nature of powder, technically termed "P. powder," is made with the same ingredients, and with the same proportions, as ordinary service gunpowder.

The mode of manufacturing "P. powder" is somewhat different in some of the processes to that of ordinary powder, especially in the density, which varies from 1·75 to 1·80, and in the drying of the powder. The pebbles or cubes are formed by cutting up the "press-cake" into lumps of the required size by means of a machine, the sharp edges of the lumps or cakes being removed by glazing in a revolving barrel.

The object of using gunpowder of such large-sized grains is to relieve the gun of the great pressure or strain exerted by a smaller grain, the pressure of P. powder being a third less, or even more, in heavy guns (with which it is only used), than R.L.G. powder. Great improvements have been made in the manufacture of this powder since it was first introduced. In a lecture given by Captain Morgan, R.A., at the United Service Institution, in March 1874, he remarks on the inconsistencies observed in the result of the early experiments with this nature of powder, and the difficulties attending the manufacture of it, so as to arrive at uniform results; but after much seeking and experiments, and the proof of a vast number of samples, he says, "I fancied I saw into the secret recesses of pebble powder and its mode of action. The whole question seems to lie in the porosity of the grains. The more porous the grains the more violent will be the action." Hence is apparent the necessity of giving this powder increased density. But this alone did not procure the best powder required. It was found necessary also to extract, by increased heat and stoving, the moisture within the pebble, as its absence or otherwise affected the ignition and uniformity of ignition, causing, when all the moisture was not extracted, a speedier explosion of the grains, and therefore a great pressure on the gun. This action would also affect the uniform velocity of the shot at the mouth of the piece. As Captain Morgan remarks, "this part of moisture, if not dried out of the pebble, might, for all we know, generate steam within the pebble on being ignited, and by its action cause considerable porosity in the several pebbles of the charge."

**Peddowk** (*Pterocarpus dolbergiodies*)—A tree which grows in the forests of Burmah and the Andaman Islands. It resembles mahogany in its colour. It was formerly much used by the Burmese for gun carriages, and was introduced, some years back, into the gun carriage manufactory at Madras. A cubic foot of unseasoned wood weighs from 65 to 70 lbs.

**Peemah** (*Lagerstrœmia reginæ*)—A tree which grows in India and Burmah, and is made use of in the Madras gun carriage factory for certain portions of gun carriages. It is a light and tough wood. There are two descriptions of it, red and white coloured; the former is the tougher of the two. A cubic foot of unseasoned wood weighs from 50 to 52 lbs.

**Pellet Powder**—This powder, in place of being made into press-cake, and then granulated, which involves the formation of a quantity of smaller grains and particles, is pressed into a number of cylindrical pellets, about ·5 inch long, ·75 inch in diameter, perforated at one end to about the centre. The object is to obtain a comparatively slow-burning powder, having a large and uniform grain or pellet. The pressure that this powder exerts on the walls of a gun is much less than that of the ordinary R.L.G. This powder is not used in the service.

**Pell-mell** (French, *pêle-mêle*) — Confusedly; in disorder; in heaps, &c.

**Penal Servitude** — A punishment awarded by the Articles of War for certain crimes committed by soldiers.

**Pendulum** — In mechanics, denotes "any body so suspended that it is at liberty to vibrate or swing backwards and forwards about a horizontal axis of suspension by the action of gravity. The vibrations of a pendulum are called its oscillations; the time of each being counted from the time of its descent from the highest point on one side, till it attains the highest point on the other side.

"The lengths of pendulums vary according to the force of gravity in different latitudes, the increment above the force at the equator being nearly as the square of the sine of the latitude; and since the length of the second's pendulum is directly proportional to the force of gravity, the increment in its length above the length at the equator varies also as the square of the sine of the latitude. Hence, if 39·0265 be the length of the second's pendulum at the equator, and 0·1608 the increment in its length at the pole, the length *L of the pendulum* in any latitude, $\lambda$, is given by the equation $L = 39{\cdot}0265 + 0{\cdot}1608 \sin^2 \lambda$."

**Pendulum, Gunner's**—Consists of an upright frame of wood, having a cross-arm attached to it, from which a pendulum is suspended, vibrating seconds, consisting of a string with a leaden ball, measuring, from the point of suspension to the centre of gravity of the ball, a length equal to a second's pendulum having reference to the latitude; in latitude 22° the length is 39·1. It is used to measure the time of flight of a mortar shell.

**Pendulum, Navez'**—The principal part in Navez' electro-ballistic apparatus. It is thus described by Captain Noble, late R.A.:—"The principal parts are the pendulum and graduated arc. The pendulum, before an observation, is held suspended by an electro-magnet, the current magnetising which passes through the first screen. To the pendulum is attached, by means of the pressure of a spring, an arm with a vernier. The pressure of this spring is so regulated that the arm vibrates freely with the pendulum, but at the same time it offers but little resistance to the action of a powerful horse-shoe electro-magnet, which, when the circuit magnetising it is complete, clamps the vernier arm with great firmness."

**Pendulum Sight**—A graduated sine scale, by means of which a gun on an incline can be directed on an object without making any allowance for one wheel being higher than the other. It consists of an upright piece of sheet brass, and has a movable slider and scale. At the lower end a bulb or disc is placed, filled with lead. The scale passes through a slit in a piece of steel, and is connected with it by a brass screw, which serves as a point on which the scale vibrates laterally; the slit is made long enough to allow the scale to assume a vertical position in any ordinary cases of irregularity of the ground on which the gun carriage may stand. The ends of the piece of steel are formed into journals or trunnions, by means of which the scale is supported on the seat attached to the base of the breech, and is at liberty to vibrate in the direction of the axis of the piece. This sight is believed to be the invention of a Russian officer, and the Americans adopted it for their artillery. A similar pendulum, a few years back, was brought to the notice of the Indian government by the late Captain Butt, of the then Bengal artillery, who, unaware of the Russian invention, submitted his pendulum sight for the approval of the Indian government, which, after trial, was reported on most favourably, and directed to be attached to all mountain pieces. Captain Butt thus describes the error of the tangent scale when the carriage is on uneven ground, and the correction the pendulum sight affords:—

"The line between the two sights at the muzzle and breech being parallel to the axis of the piece, the gun (if it have a dispart sight) can always be laid correctly point-blank; the error begins with the elevation, when the tangent scale is drawn out obliquely (instead of vertically, as it should be), and the horizontal distance between the breech sight and the axis being greater than the horizontal distance between the muzzle sight and axis, the line of the sights produced crosses the line of the axis produced. The pendulum sight starts from the same fixed point as the tangent scale, but it rises vertically, and every point on it is at the same horizontal distance from the axis that the muzzle sight is, and the line of the sights produced is always parallel to the line of the axis produced. In attaching the pendulum to the gun, care must be taken that the fulcrum of the pendulum and the muzzle sight be in the same plane with, and equi-distant from, the axis of the piece."

This instrument is not used with rifled guns, as they have a deflection scale, which corrects the position of the gun when one wheel is higher than another.

**Penetration**—The depth a projectile buries itself into earth, masonry, iron, wood, or snow. As stated in Lieutenant-Colonel Owen's work on 'Modern Artillery,' "the penetration of a projectile depends upon a variety of circumstances, such as its velocity at the moment of impact, the charge given, its form, density, diameter, nature of the object struck, and the relative position of the latter with regard to the trajectory or path of the projectile. Elongated shot at long distances penetrate farther than spherical, the velocity of the former not decreasing so rapidly as the latter. Further, in the penetrating powers of elongated projectiles fired from rifled guns, the form of head has much to say to the disruptive effects on the object struck; and it has been found from experience that the ogival-headed shot is much more penetrating and destructive than any other form." The reader is referred to the work alluded to above for the formula for working out the penetrative power of projectiles into different materials.

In experiments which have been made with cannon shot into plates of varying thickness, it has been found that little difference in resistance exists, whether a solid plate is being fired into, or plates of the same thickness composed of layers. Thus, for instance, the resistance is much the same whether the plate be 15 inches thick or three plates of 5 inches. Again, it has been found that 33 foot-tons per inch of shot's circumference (in 7 inches calibre) represents the limit of resistance of a single 5-inch plate. Two 5-inch plates give three times the resistance of a single one, and three 5-inch plates six times. (*Vide* Appendix P.)

**Pennon** (Latin, *penna*, a feather)—A military ensign, which in the reign of Edward I. took the place on the lance of the *gonfanon*. It appears to have resembled it in its swallow-tailed form, but was longer and broader. This military ensign is generally charged with the crest, badge, or war-cry of the knight; his arms being emblazoned on the banner.

**Pension** — In the British service, a pension is understood to be an annuity, granted as compensation for wounds, or in consideration of length of service. In the Indian army, the annuity or retired pay given to an officer is called a "pension," the amount of which depends upon his rank and length of service. For instance, a captain on the old Indian cadre is entitled to the pension of that rank after 20 years. After 22 years, he may succeed to the pension of his rank, whatever that may be, but this is not applicable to officers of the Indian staff corps. After

24 years, an officer is entitled to a major's pension; after 28 years, to that of a lieutenant-colonel; after 32 years, to the pension of a colonel; and after 35 and 38 years respectively, to increased pensions. The widows and orphans of officers also receive pensions.

Soldiers receive pensions for long service, good conduct (*q. v.*), or disability. Claims by soldiers to pensions can be forfeited for bad conduct, but they can be restored by an undeviating course of good behaviour or gallant service spread over a certain number of years.

**Pension, Good-service,** *vide* Good-service Pension.

**Pensioner**—A soldier who receives a pension from the government he has served.

*In-pensioner*, a worn-out soldier, for whom a home is found in Chelsea Hospital (*q. v.*).

*Out-pensioner*, a pensioned soldier, but not maintained in Chelsea Hospital. All out-pensioners are to be ready to join the ranks when called upon to do so.

**Peon**—In India, a term formerly given to a foot soldier, but in these days it does not bear this signification. Native servants or messengers attached to the government offices in India are designated peons, and wear a belt with a brass plate bearing the name of the office to distinguish them from private servants.

**Perambulator** — In surveying, an instrument for measuring distances, named also the pedometer and surveying wheel. There are two kinds: one with a large wheel, requiring two men to turn it; and the other a smaller kind, which one man can direct.

**Perch**—In artillery, the beam of an ammunition wagon or carriage, by means of which it is connected with the limber.

**Percussion**—The impression made by one body falling or striking upon another. Of percussive applications, one that we are most familiar with is the percussion lock in small-arms striking a cap; the cap is charged with a fulminating material which ignites on the hammer falling upon it. Another is a percussion fuze that explodes the shell on its striking an ject. Gunpowder, when suddenly struck, found to be percussive.

**Percussion Caps,** *vide* Caps, *Percussion.*

**Percussion Fuze,** *vide* Fuze.

**Perforated Disc Gunpowder** — Compressed gunpowder, perforated with a certain number of holes. From the excessive pressure given to the discs, the powder burns slowly; it has been and is still used for discharging rifled ordnance by some foreign artilleries. In the British artillery it is not used.

**Perimeter** (Greek, *peri*, around; *metron*, a measure)—The perimeter of a figure is the sum of all its sides taken together.

**Periphery** (Greek, *periphero*, I carry round)—The circumference of any curve, as the circle, ellipse, parabola, &c.

**Permanent**—Anything which is made to last an indefinite time, such as permanent fortifications, barracks, &c. The term is also applied to substantive *rank* (*vide* Rank) in the army.

**Perpendicular**—When a straight line standing on another straight line makes the adjacent angles equal to one another, each of these angles is a right angle, and the line perpendicular.

**Persian Wheel** — A contrivance for raising water from a well or stream, and used in the country from which it takes its name. It is also extensively used in Egypt, where it is known as the *saquieh*, in northern India, in the Punjab, in Sinde, and also in Spain as the *noria.* It consists of a wheel, about 4 feet in diameter, revolving on a wooden axle, which is flush with the mouth of the well, and is set in motion by means of a driving wheel turned by a pair of bullocks. The wheel has on its rim pins of wood inserted into it, at short distances apart, to which buckets or jars are suspended by means of an endless band or double rope; the buckets descend on one side into the well and ascend on the other filled with water, and discharge themselves into a reservoir at the mouth of the well. The Persian wheel, used for raising water from a stream instead of a well, has the buckets somewhat differently arranged for lifting the water, but the principle is the same.

**Personnel**—A French word introduced into our military language, as meaning the *ensemble* of persons forming part of an administration or of a body. The *personnel* is one of the two (and the effective) subdivisions forming the numerous elements composing an army, the *matériel*, or non-effective, being the other.

The *personnel* is levied in conformity with such custom as may prevail in each state, or such laws as the government of the state may see fit to adopt.

**Perspective**—In drawing, "is the method by which all objects are portrayed on a plane surface, as in a picture, according to their appearance in their real situation. Perspective is of two kinds, linear and aërial, the first having reference to the form of on object, the second to its distinctness and colour."

**Petard**—A machine (now obsolete) in the shape of a cone or bell, made of bronze or cast iron, and loaded with gunpowder. Petards were formerly used for bursting open gates, barriers, &c. The invention of this nature of machine dates as far back as 1579, when, it is stated, the Huguenots took the town of Cahors by means of "pétards."

**Petroleum,** *vide* Oil.

**Pettman's Fuze**—A percussion fuze invented some years ago by Mr. Pettman, a workman in the Royal Arsenal at Woolwich, and introduced subsequently into the service. There are two kinds, the L.S. and G.S. The former is used with common shell of common gauge; the latter acts equally well from a S.B., B.L. or M.L.R. gun.

**Pewter** (Normandy French, *péautre*)—An alloy of tin and lead; but the best pewter is made of 12 parts of tin with 1 part of antimony and a very small addition of copper.

**Phalanx**—Peculiar to the Grecian army. It consisted of a square, compact body of men, closely formed, with their shields joined and pikes across. This was called the *Macedonian phalanx*, and numbered about 8000 men.

**Phosphorus** (Greek, *phōs*, light, and *phŏros*, bearing)—Symbol, P; atomic weight, 31; sp. gr. 1·826. A highly inflammable elementary substance, obtained from calcined bones, which emits light when placed in the dark, owing to its undergoing a slow combustion.

In combination with tin and copper, it forms what is termed *phosphor-bronze*, and has been used in the manufacture of *guns and tools.* From experiments made in 1870, in Belgium, with guns of this nature, manufactured by Messrs. Montefiori-Levi and Künzel, the inventors of this phosphor-bronze, it was found that the increase in the tenacity of the alloy by the addition of phosphorus was very great, and proved that phosphoric bronze was much harder than ordinary bronze; but it showed itself, from experiments some years previous, an unreliable metal, as the gun suddenly burst without giving any indication, after examination of the bore, that it was likely to do so. Such an occurrence, which would not have happened with the ordinary bronze, is fatal to the use of this alloy, as no more dependence can be placed on it than on a gun made of cast-iron or steel. (The Germans in their report on it say just the contrary.)

Subsequent experiments were made in France and Belgium by Dr. Künzel, and it is stated that he had discovered a mode whereby the amount of phosphoric action can be assured in any degree that may be desired. This certainty of result appears to be wanting in every other description of phosphor-bronze. The method adopted by Dr. Künzel is kept secret. The result of treating this alloy appears satisfactory, and should the bronze not come up to what is expected of it for guns, its utility for many other purposes cannot be questioned.

There is one peculiarity with regard to this alloy which is worthy of notice. It differs from all others in the fact that it can be produced in a definite manner, without any difficulty as to the precise degree of hardness required. It is also singularly pure and homogeneous, and can be produced, it is stated, free from all tin spots and imperfections.

The hard phosphor-bronze is less liable to emit sparks when brought into violent contact with gritty substances than either copper or gun-metal, and for this reason found of great use for implements and tools used in the manufacture of gunpowder. It has been found to answer in the royal carriage department as a material for the construction of sheaves for blocks and of bearings for engines and grindstones.

**Photography** (Greek, *phōs*, light, and *grapho*, I write)—The art of producing pictures from nature by the action of light upon certain chemical preparations. The adaptation of this beautiful art to military purposes has never extended beyond that of copying, enlarging, and reducing maps and plans. But it has been shown by a Frenchman, M. Auguste Chevalier, that it can be applied still more usefully to surveying.

This ingenious method of surveying is thus described by Lieutenant-Colonel illie, of the Bengal staff corps, in a lecture before the Royal Institution in 1869: "It consists in taking small circular pictures or panoramas round each station of the triangulation into which the survey is divided. These panoramas are printed by the ordinary photographic method, and are cut out and fastened on a sheet of drawing paper in the relative position to each other which they occupied on the ground to be surveyed; and straight lines or radii being produced from the centre of each, through the objects shown in them, give by their intersections the relative position of each object on the paper, so that the 'filling in,' as it is technically termed, is completed as rapidly as these intersections can be plotted."

Such a system dispenses with the slow process of observing each object separately, and the liability to any possible error in recording the observation in the field-book, which is now quite dispensed with.

**Photozincography** and **Photolithography**—The processes by means of which photographic facsimiles of original manuscripts, engravings, drawings, or letterpress, may be made on the same or any desired scale, and transferred to a zinc plate or lithographic stone, so that any number of copies may be printed off directly in the same manner as in ordinary zincographic or lithographic printing.

The utility of such a process for copying old and rare original manuscripts or maps and plans of all kinds for the use of engineers and others will at once be apparent, and it has already been largely adopted at the Ordnance Survey Office, Southampton, for the reproduction of maps and manuscript records; at the India Museum, London, for the reproduction of patterns of Indian fabrics; and at Woolwich Arsenal, for the reproduction of drawings of ordnance equipment, &c. It is also largely used by the war departments of the various European states and in America, but in no country in the world has photozincography been so extensively and so usefully applied to the reproduction of maps as in India, where skilled lithographic draughtsmen and engravers are very scarce. It has been most successfully worked in the surveyor-general's office, Calcutta, in the office of the superintendent of the Great Trigonometrical Survey, Dehra Dhoon, and in the photozincographic office of the Bombay government at Poonah. By its aid the maps of the various surveys are issued to the public within a few months after the completion of the survey, instead of being kept back for years, as they would be, had they to be lithographed or engraved. Besides being used in so many government offices, this process is extensively worked by private individuals in Europe and America.

Several processes of this kind have been introduced from time to time, but one of the most efficient for general purposes is that practised at the Ordnance Survey Office, Southampton, and in the Indian survey offices.

It is of course impossible in a work like the present to enter into full practical details, but the following short sketch will be sufficient to give a general idea of the working of the process.

The process consists in printing from a suitable photographic negative on to a sheet of paper coated with a mixture of gelatine and bichromate of potash. After exposure to light, the print is evenly covered with a thin coating of lithographic transfer ink, and washed in warm water to remove the unaltered gelatine in the unexposed parts, and with it the superfluous ink, while the insoluble gelatine forming the lines retains the ink, and thus a perfect copy of the original is obtained in greasy ink, which may then be transferred to zinc or stone and printed in the ordinary way. The success of the operations in copying maps and drawings, &c. by this process depends entirely upon the ground of the negative being perfectly opaque, while the lines are as clear as the bare glass;

and in order to insure the best results, the plans should be specially drawn for the purpose on smooth white paper in *perfectly black* ink. Pale ink or washes of any colour except light blue must on no account be used. The lines should be firm and clear, and the work as open as possible; and when the plan is intended to be reduced, care must be taken that the lines are drawn sufficiently thick to produce the required effect when reduced.

The plan must be placed in a good light, and the camera carefully adjusted, so that the plane of the ground glass may be perfectly parallel to the plane of the plan, so as to avoid distortion; and the apparatus must be firmly fixed to prevent vibration, which would injure the sharpness of the lines. The negative is taken by the usual wet collodion process, slightly modified in order to secure the greatest transparence in the lines; but as this alone will not give sufficient intensity, it is obtained by intensifying the negative in the usual way, then applying a saturated solution of bichloride of mercury till the film becomes white, and afterwards applying a dilute solution of hydrosulphate of ammonia, which instantly changes the colour of the film to a dark black or brown colour. It is afterwards varnished.

The next operation is to print from this negative a photograph in greasy ink which may be transferred to zinc or stone. To obtain this, advantage is taken of the property possessed by alkaline bichromates of rendering gelatine, gum, albumen, &c. insoluble under the influence of light, and at the same time giving them an affinity for greasy ink.

To prepare the sensitive paper, a sheet of bank post paper is coated in the dark with a mixture of from 3 to 5 parts of gelatine, 1 to 2 parts of bichromate of potash, and 50 parts of water, and hung up to dry; then coated again and hung up to dry by the other end, so as to equalise the coating. Before use, the paper is passed through a glazing-press to smooth the surface. It is then exposed to light under a negative from 1 to 3 minutes in the sun, or until the finest lines are distinctly visible. When *sufficiently* exposed, it is taken out of the printing frame and passed through a lithographic press in contact with a polished zinc plate which has been rolled in with thin re-transfer ink, and thus receives an even coating of greasy ink. It is then immersed for a few minutes in a trough of water to soften the gelatine still remaining soluble in those parts which have not been acted upon by light. It is next laid on a sloping glass slab, and washed with a sponge and tepid water till all the unaltered gelatine is washed away, carrying the superfluous ink with it, while the lines on which the light has acted remain insoluble and retain the ink. When all the details are clearly and sharply defined, and the ground quite free from ink, the print is rinsed with clear water, dried, and is then ready to be transferred to zinc or stone, just as an ordinary transfer drawing.

The zinc plates used for the purpose are about $\frac{3}{16}$ inch in thickness, and have one surface carefully planed and smoothed; but in order to give a somewhat porous surface to the plate, so that it may be more absorbent of moisture and greasy ink, the planed side of the plate is grained by being rubbed with very fine sand and water; the sand is sifted through a sieve of 120 holes to the linear inch. After the transfers are made, the plate is etched with a preparation of gum and decoction of nut-galls, to which a little phosphoric acid is added. If the transfers are made to a lithographic stone instead of a zinc plate, the operations are conducted just as in transferring an ordinary lithographic drawing, except that the stone need not be heated. The operations of printing, whether for zinc or stone, are just the same as in ordinary lithography.

**Phowra**—An Indian term for a kind of spade or hoe. (*Vide* Mamootie.)

**Phunsee** (*Carallia integrifolia*)—A tree which grows in the Bombay presidency and in the Tenasserim and Martaban provinces. It is tough, and not easily worked. It is used in the Bombay arsenals for sponge staves.

**Physique** (French)—A term meaning the physical state of a man or of an army, in contradistinction to their moral.

**Pice**—A quarter of an anna, equal to

three pie. The commonest coin in circulation in an Indian bazaar.

**Pickaxe**—An instrument having a sharp point at one end and a blade at the other. It is used in all military works where the earth has to be loosened.

**Picket, To**—To secure or fasten horses in their lines, in camp, or in cantonments. This is effected by fastening the head and heels of the animal by ropes or chains to pegs of wood termed pickets; hence the term "to picket" a horse.

**Pickets**—Small detachments taken from the outposts, in numbers depending upon the strength of the advanced guard, and posted at an average distance of 400 yards to the front of the outpost.

It is truly said that the "real outposts of any body of troops are the pickets, with their dependant small bodies, patrols, and vedettes. They are in the line nearest to the enemy, and on them devolve the most important of the duties and cares of watchfulness. Their number and strength depend on the nature of the line of country to be occupied, the nearness of the enemy, and his probable operations, while other circumstances may also have their influence, such as the proportion of men who can be easily furnished for the duty, &c. As a rule, 20 or 30 men is a reasonable strength for a picket."

If pickets in larger force are required, it would be better to have two small pickets than one large and unwieldy one. The duty of pickets is to watch for the enemy, and, if in view, to note his every movement; to guard against surprises, and in case of attack to be the first to receive and oppose it.

*Inlying pickets* are detatchments of the army, generally a company from each battalion, told off to remain in camp, but fully accoutred and ready to turn out instantly in case of alarm.

*Outlying pickets* are detachments of cavalry and infantry, accompanied sometimes with light guns, and posted on the front and flanks of an army in the field, in order to guard against surprise, and to keep reconnoitring parties at a distance. (*Vide* Outposts.)

**Pickets, Mortar,** *vide* Pointing Rods.

**Pickets, Park**—Small wooden posts which support the rope line round the artillery park. They are *carried either* on carts or camels in India when on the march. Dimensions—length 53 inches, and diameter 3 inches.

**Pickling**—A process pursued in cleaning plates, iron or copper, or castings of these metals. It is effected by allowing the metals to remain some hours in a diluted acid.

**Picric Powder**—A combustible invented by Mr. Abel. It is of a bright yellow colour. It is far more powerful than gunpowder, and very satisfactory results have been obtained from it. It appears to be less susceptible than gunpowder to ignite by means of friction or a blow.

**Pie**—An Indian coin representing the twelfth part of an anna.

**Piece**—A term generally applied to all ordnance.

**Pierrier** (from the French *pierre*, a stone)—A species of mortar once used for throwing stones; it is termed a stone mortar.

**Piers**—In fortification, are kinds of buttresses on which the roadway of a bridge rests. Piers are made of barrels in the case of wooden bridges.

**Pig Iron**—The name given to cast iron run into moulds, forming semi-cylindrical bars.

**Pigeon,** *vide* Carrier Pigeon.

**Pike**—A weapon formerly much in use in the English army, as early as the Norman Conquest. In the reign of William III. it was superseded by the bayonet. The pike had a shaft from 10 to 18 feet long, with a flat-pointed steel head called the spear.

**Pikemen**—Men who were armed with the pike. From the reign of Henry VIII. to that of William III. the greater part of the English army was formed of pikemen.

**Pile Arms, To**—To place three muskets with bayonets, fixed or unfixed, in such a relative position that they shall mutually support each other. This is done when men stand from their arms either on parade, on the march, or in camp.

**Pile Driver,** *vide* Hammer, Steam.

**Piles**—Beams of wood driven into the ground to form a solid foundation for building. For wharves and jetties, piles boarded over form admirable landing-places and good frontage for river banks.

**Piles, Barrel**—Refers to the mode pursued in "piling" barrels in magazines, which is shown in the undermentioned formulæ, by Captain S. E. Pemberton, R.A.

*Case* 1.—Pyramid pile.

$$S = 1 + 2 + 3 \ldots\ldots + n;$$

where $S$ = number of barrels,

$n$ = number in bottom row.

$$\therefore S = \frac{n(n+1)}{2} \ldots\ldots\ldots\ldots (1)$$

In an incomplete pyramid pile,

$$S = \frac{n(n+1)}{2} - \frac{(m-1)m}{2}$$
$$= \frac{n^2 - m^2 + n + m}{2}$$
$$= \frac{(n+m)(n-m+1)}{2}; \ldots (2)$$

where $m$ = number in top row.

*Case* 2.—Where *one* end of the pile rests against an upright, and *the top row does not touch* the upright.

$$S = n^2 - m^2;$$

where $n$ = number in bottom row, and $m$ number in top row.

Suppose the pile continued till $m = 1$. Then,

$$S = 2(1 + 2 + 3 \ldots\ldots + n) - n - 1$$
$$= n(n+1) - (n+1)$$
$$= (n+1)(n-1) = n^2 - 1; \ldots\ldots (3)$$

and in an incomplete pile,

$$S = (n^2 - 1) - (m^2 - 1) = n^2 - m^2 \ldots (4)$$

*Case* 3.—If the top row touch the upright.

$$S = n^2 - m^2 + m \ldots\ldots\ldots\ldots (5)$$

*Case* 4.—Where the barrels are piled *between two uprights* so that if bottom row = $n$, second = $n - 1$, third = $n$, and so on.

If top row = $n - 1$, i.e. if top row do not touch the uprights,

$$S = mn - \frac{m}{2} = \frac{m}{2}(2n - 1); \ldots\ldots (6)$$

*where $m$ = number of courses.*

When top row = $n$, i.e. when top row touches uprights,

$$S = mn - \tfrac{1}{2}(m - 1)$$
$$= \frac{m(2n-1)+1}{2} \ldots\ldots\ldots\ldots (7)$$

These results, being only calculated for piles of one barrel in depth, must of course be multiplied by the number of barrels in the *depth* of the piles.

**Piles, Shot**— Shot or shell piled one above another. Spherical shot are piled according to their nature and calibre, and under cover if practicable; for though all shot and shell are painted, when exposed, they are more or less subject to atmospheric influences which corrode them. In piling shot, the piles should be made as narrow as possible, to facilitate a free circulation of air between the layers. The ground for the base of a pile should be prepared by raising it above the surrounding ground, so as to throw off the water; it should then be levelled, well rammed, and covered with a layer of screened sand or charcoal. The bottom of the pile is usually made with a tier of unserviceable shot, buried about two-thirds of their diameter in the sand; the base should be well cleaned, and the pile now formed, putting the fuze-hole of shells downwards, in the *intervals*, and not resting on the shells below. The base may be made of brick or stone. Canister should be piled in store-rooms on the ground floor.

Shot should he painted or lacquered as soon as possible after they are received, and when repainted, the old paint should be scraped off.

*To find the number of shot in a triangular pile.*—Multiply the number in the base by the same + 1, and this product again by the base + 2, and divide by 6.

*To find the number in a square pile.*—Multiply the corner row by the corner row + 1, then this product by twice the corner row + 1, and divide by 6.

*To find the number in an oblong pile.*—From three times the length of the base + 1, subtract the breadth, and this product by the breadth + 1, and divide by 6.

*In an incomplete pile*, according to either of the preceding rules, find the number in the pile considered as complete, then the number in the upper part, and the difference between the two piles will be the number in the incomplete part.

The above calculations are for spherical shot.

Oblong shot and shell (Armstrong) are piled in rectangular piles.

$$s = (2n + r - 1) \frac{m\,r}{2},$$

where $n$ = number in length of top course, $r$ = number of courses, $m$ = number in breadth.

The following formula has been recommended for elongated projectiles, as communicated by Captain R. O'Hara, R.A., to the Royal Artillery Institution:—

Let B = number in breadth of pile:
L = number in length

$$S = \frac{B\ L}{2}\ (B + 1).$$

**Pillage**—The act of plundering. (*Vide* Maraud, To.)

**Pillar Fuze**—This fuze (now obsolete) was used with all the heavier natures of Armstrong shells, as a concussion fuze.

**Pin**—A short piece of wood or metal, generally with a head and a hole at the other end to receive a key. There are many sorts used in army material.

**Pin, Linch**, *vide* Linch Pin.

**Pincers, Gun**—An instrument used for extracting a bit or drift from the vent of a gun.

**Pinching**—In artillery exercise, is the operation of moving a gun or mortar by small heaves of the handspike, without allowing it to turn on its axis. It is moved little by little, and rubs against the skid on which it rests.

**Pinion**—In mechanics, a spindle in the body of which there are several notches into which the teeth of a wheel catch which serves to turn it round; it is also the name of a lesser wheel which plays in the teeth of a larger one.

**Pintail**, or **Pintle** — A hook attached to the rear of the limber axle-tree bed of a light field carriage to enable the gun or ammunition carriage to be limbered up to it. In this position the gun forms a counterpoise to the weight that would otherwise rest on the shafts. It is calculated that the weight on the horse's back of a fully packed limber, with the hook fixed to the axle-tree bed, averages about 75 lbs. In heavy howitzers and siege carriages formed with bracket sides, the pintail is either a stiff or movable iron perch, attached to the *top of the* limber axle-tree, to which the gun carriage is limbered up by a hole passing through the rear transom; this mode of limbering up is necessary in consequence of the weight and dimensions of the trail.

**Pioneers**—A small body of men (one per company), attached to each infantry regiment for the purpose, whilst on the march, of clearing the road, and cutting down all obstacles, such as trees, jungle, &c., as may be found necessary for the onward progress of the regiment or army. Each pioneer, besides carrying a tool of some description, carries a saw-backed sword, which serves both as a weapon and a tool. Besides being made use of for the purposes named, the pioneers are to be regarded as a small corps of regimental artificers, competent to put a hand to any work that may be required at home or abroad; and also capable of imparting instruction to men desirous of learning a trade. With this view, men of trades should be enlisted, if possible, or men of the regiment should be placed for instruction in government workshops, such as the Woolwich Arsenal or School of Military Engineering at Chatham. The Queen's Regulations explain very fully how the men are to be instructed.

**Pipe, Trace**—The leather pipe or covering of a horse trace.

**Pipe-box**—The cylindrical box in the nave of a wheel in which the axle-tree arm works, and in which is a recess for holding grease. A hard alloy, technically known as "metal," composed of copper, tin, and zinc, is now used as the material for pipe-boxes in preference to cast iron, on account of the less development of friction between it and the iron arm.

**Pipe-clay**—A silicate of alumina. It is a white argillaceous earth, with which soldiers' belts are cleaned. It is found in the Isle of Purbeck, in Dorsetshire, and at Teignmouth, in Devonshire.

**Piper**—One who plays a reed instrument. The men who play the bagpipes in a Highland regiment are termed the *pipers*.

**Pistol**—A kind of fire-arm, of which there is an infinite variety, from the single- and double-barrelled pistol to the many-barrelled revolver. The pistols furnished to the lancer regiments and to troop sergeant-majors of cavalry are M.L.R. pistols. Pistols were first known in the reign of Henry VIII. (*Vide* Appendix F.)

**Piston**—In machinery, a movable air-tight division within the steam cylinder, acted upon by the steam. Pistons are either *metallic* or *packed.* Metallic pistons usually have segments of brass or cast-iron, called junk rings, pressed outward by springs. Packed pistons are surrounded by well-greased hemp.

A *piston-rod* is fixed to the piston to communicate its motion to the crank. This rod is turned exactly circular, and passes through a circular hole in the centre of the cap of the cylinder, the hole being made to fit the rod so exactly as not to let the steam escape, and to move at the same time so freely as to require very little power to urge it.

**Pit Charcoal**—Wood charred in a pit instead of in closed retorts. The operation is performed as follows. From 3 to 4 cords of wood (a cord of wood measures 14 × 3 × 3 feet, or 126 cubic feet) are built up in a circular mound about 10 feet in diameter, and 5 feet high, having a hole left in the centre which acts as a chimney. The mound of wood is then covered with stubble or straw, 3 or 4 inches deep, and over this a layer of charcoal dust or sand about the same thickness. Lighted charcoal is put down the chimney, which is now closed up. The process of charring then commences. A shifting screen is always placed to windward to regulate the draught, and small holes are left at intervals to allow of the escape of the vapour. After three days and nights the operation is completed. Pit charcoal is used for firework composition, and also as an ingredient in the manufacture of pit-powder.

**Pitch**—A thick substance obtained by boiling down tar to the requisite consistency, either by itself or combined with a portion of rosin; it becomes solid on cooling, but is soon softened by the heat of the hand, in which state it is very adhesive. When of good quality, it is clear and hard. It is used in making carcasses, light-balls, kit, and smoke-balls.

The term is also used in wheel-work, signifying the distance between the centres of two contiguous teeth. *Pitch-line* is the circle concentric with the circumference which passes through all the centres of the teeth.

What is known as the *pitch of a screw* is the interval between the points of starting and arrival of a complete revolution of a screw, and consequently of the thread of a screw, which is traversed by the screw, or its thread, when it has completed an entire revolution. The pitch is therefore independent of the diameter of the screw.

In rifling, the *pitch* is described by Captain J. B. O'Hea, in his lecture at the United Service Institution, as "resistance to the direct progressive motion of the projectile through the bore. This resistance varies according to the incline as well as the pattern of rifling; for as the more defined the pattern the more the resistance, so the sharper the pitch the greater the rotation of projectile round the axis of progression, and consequently the more difficult its initial and the slower its direct forward motion." There are two natures of pitch, an increasing and decreasing pitch, the merits and demerits of which are described in the above officer's lecture.

**Pitch a Tent, To**—The act of raising a tent from the ground and setting it up in such a manner as to make it habitable. There is an art in pitching a tent, and the men of a regiment should be instructed from time to time how to pitch their tents and to strike them ready for a march; but they will soon come to know how to do so, even if they have had no previous experience, when once they enter on camp life.

The tents used in the British army out of the tropics are *circular tents*, comparatively small to those under which soldiers encamp in in India, and which in consequence of their limited size do not entail the same time or trouble in pitching. Nevertheless, it requires experience to pitch a tent in England, and to pitch one in India. The tents in the latter country are roomy and lofty, and, but for the carriage they entail, would be all that could be desired on the march. Soldiers soon get into the way of pitching these tents, and it is astonishing, after a regiment arrives on its encamping ground, to see with what ease and rapidity they erect them. The great thing in pitching a tent is not to dig inside but outside of it, viz. to use such means, in case of rain, that water shall not flood the tent. This, however, cannot always be prevented, but a drain dug all round the tent to the lowest ground may save a flooding. Then, again, to secure a tent from being blown down, the corner ropes should be bushed. (*Vide* Bushing Tents.)

The 'Soldier's Pocket-book' gives the mode of pitching a *circular tent*, and what it states about the sides of tents being rolled up, if the weather be fine, is very desirable; it is the means of ventilating the tents, and in a sanitary point of view very necessary.

**Pitching Fire,** *vide* Curved Fire.

**Pits**—In warfare, are generally hasty excavations made in the earth, for the purpose of giving protection to men, guns, horses, &c. The following are the pits alluded to, which are of various dimensions and forms, and which will be found under their respective heads:—

| | |
|---|---|
| Charger Pit; | Limber Pit; |
| Gun Pit; | Military Pit; |
| Horse Pit; | Rifle Pit; |
| Shelter Pit. | |

**Pit-saw**—An instrument used in sawing up timber at the pit. It is worked vertically by two men, called the *top-man* and the *pit-man*; the former, as his name implies, stands upon the surface of timber to be sawn. The pit-saw is about 6 to 8 feet in length, according to the size of the timber. To adapt it to the hands of the sawyers, it has at the upper part a transverse handle, or *tiller*, and at the lower a box. The introduction of circular saws, driven by steam, has, to a great extent, done away with the cutting up of timber by hand-work.

**Pivot**—A point, fixed or movable, on which a body turns. It is applied to the fixed or halted pivot of a company of soldiers at drill; to that point on which an axle turns; to the pivot of the nut of an elevating-screw; &c. The application of the term is endless.

**Pivot Flank,** *vide* Flank, Pivot.

**Places of Arms**—As applied to India, are buildings in several of the cantonments in which the arms and accoutrements of a native regiment are kept. Each company has its *proper allotment* of arm-racks and pegs. Only 12 rounds of ammunition in pouch are kept in these buildings; the rest of the ammunition is retained in the regimental magazine, and spare arms belonging to men on furlough are lodged in the quartermaster's stores.

**Plaid**—A woollen shawl of a tartan pattern, worn over the shoulder by the Scotch Highlanders, and still worn by Highland regiments.

**Plain Clothes**—A citizen's every-day dress, as applied to an officer not in uniform; this dress is also known by the familiar name of *mufti* (*q. v.*). It is left to the discretion of general officers commanding, to permit the use of plain clothes for the purpose of recreation; otherwise all officers must appear in uniform in camp or quarters, or when attending public balls within the district in which they are quartered.

**Plan, Military**—The representation on paper, on a reduced scale, by means of conventional signs and process, of any portion of the earth's surface.

In fortification, a plan shows the tracing, also the horizontal lengths and breadths of the works, the thickness of the ramparts and parapet, the width of the ditches, &c. It exhibits the extent, division, and distribution of the works, but the depth of the ditches and the height of the works are not represented in a plan. (*Vide* Map.)

What is known as a *plan of a campaign* is a general and detailed outline of the operations of war to be carried on, prepared before entering upon a campaign by a government, in communication with the chief selected by them, and modified according to circumstances. There are many considerations to be taken account of in deciding upon the plan of a campaign, such as the political and geographical aspect of affairs, the relative strength of the belligerents, the facilities offered by the mobilisation and concentration of the respective armies.

**Plane**—In carpentry, a tool used by the carpenter or joiner for taking the rough surface off the timber to be smoothed in surface. The plane is a chisel inserted in one of the several forms of stocks or guides, the general object being to limit the extent to which the blade can penetrate the wood, to provide a definite guide to its path or direction, and to restrain the splitting in favour of the cutting action. There are a variety of planes, which are distinguished by their names, length, &c., and the peculiar work they are intended to perform.

In geometry, this term denotes a plane figure or a surface lying evenly between its bounding lines, such as the *horizontal plane*, which is level or parallel to the horizon; the *inclined plane*, which makes an oblique angle with a horizontal plane. The simplest form of inclined plane is to be seen in cutting a wedge through lengthways, the *vertical plane* passing at right angles to the horizontal plane.

**Plane of Fire**—In gunnery, the vertical plane passing through the axis of the gun.

**Plane of Site**—In fortification, the general level of the ground or ground line upon which the works are constructed, whether that plane be horizontal or oblique to the horizon.

**Plane Table**—Described as "an instrument much used in land-surveying, by means of which a plan is made on the spot, without any after-protraction or plotting. It consists of a plane rectangular board of any convenient size, generally about 16 inches square, the centre of which, when used, is fixed by means of screws to a three-legged stand, having a ball and socket, or universal point, at the top, by the aid of which, when the legs are fixed on the ground, the table is inclined in any direction, but can be set horizontal by means of a circular spirit level. A compass box, with a magnetic needle, is screwed into one side of the table to indicate the bearings, and to enable the surveyor to set up the instrument at a new station parallel to the position which it had at a former one.

"A brass rule or index with a sloping edge, and having perpendicular sight-vanes erected at each extremity, completes the apparatus."

**Planimeter**—An instrument used in the survey department for calculating superficial areas on paper.

**Planing Machine**—Is described as "an application of the slide-rest to plane surfaces. In the planing machine the work is firmly bolted to a table sliding in dove-tail grooves, and travelling backwards and forwards under the cutting tool, which admits of accurate adjustment. When one end of the work has escaped from under the tool, the table is moved back, and the slide-rest is moved a little way across the table, so as to take off the next shaving close to the one previously cut. It is necessary to keep the tool cool during the work, by allowing cold water to drip upon it, otherwise the edge would soon become soft."

**Plank**—A term applied to all superficial timber which is 4 inches thick and under, except 1 inch and sometimes 1½ inch, which come under the denomination of *board*.

**Plant, To**—Used in a military sense, signifies to place, to fix; as, *to plant a standard; to plant a sentry.*

**Plantations**—Trees which are sometimes planted on the glacis of fortresses. When judiciously placed, they form a valuable aid to the defence. First, in the wood being used for timber, as they would be cut down when the place was about to be attacked. Secondly, in the roots of the trees which run under the glacis forming a considerable obstacle to the besieger's saps. In the 'Instructions on Fortification, &c. at the Royal Military Academy, Woolwich,' it is stated as follows on the subject:—"Care should be taken to leave a space of about 20 feet clear in front of the crest. This part will be of no use to the besieger, as the sap of his lodgment will probably be excavated outside of it; and the defenders may have occasion during the siege to cut ramps in it ascending from the covered way to facilitate sorties, or to construct lodgments thereon for riflemen. For the same reason it would be advisable to avoid planting any parts of the glacis where it is likely the defenders will have to excavate counter-approaches."

**Plate, Armour**, *vide* Armour Plating.

**Plate, Friction**, *vide* Friction Plate.

**Plates, Range**, *vide* Range Plates.

**Platform**—A horizontal plane. It is made of stone, masonry, or wood, and for military purposes is used to place a gun or mortar upon, when standing in battery on the works of a fortification. Gun platforms are laid at different angles of inclination to check recoil.

**Platform, Gun**—A platform laid for

the efficient working of heavy ordnance, whether for siege or garrison service. By being thus provided, guns are worked with greater ease, expedition, and accuracy.

*Siege platforms* are portable, and of such a weight as to render them easy of transport. They are used for the service of guns and mortars. They consist of a floor of planks, resting on balks of wood termed sleepers. The planks are either spiked to the outer sleepers or kept down by a riband piece along the outer edges, secured by rack-lashing. Such a platform would not only be used with certain heavy guns, but for field guns, when they have to be fired for any length of time from the same spot. There are several patterns in the service, such as the *ground*, *Alderderson's*, and *Clerk's platforms.*

*Garrison platforms*, or those used for garrison guns in permanent fortifications, are made of stone, and have a slope of 1 in 15. The object of this slope is to check the recoil of the piece. There is also a *traversing platform* used sometimes when guns are mounted on garrison carriages; it is a strong frame, provided with trucks, and made to traverse in any required arc of a circle.

Since the introduction of heavy M.L.R. guns, wrought-iron *traversing platforms*, *casemate* and *dwarf* (*q. v.*), have been introduced into the service for guns of 9 tons and upwards. The gear used with these platforms consists of two main portions, viz. that for traversing and that for running the carriage in. These are worked by the same winch handles, and are arranged so that the running-in portion can be detached from that for traversing, when required for use. Several additions and alterations have lately been made to the traversing platforms and carriages constructed of wrought iron which are now in the service.

**Platform, Mortar**—A platform similar to that used with siege guns, but of smaller dimensions, and without a slope.

**Platform, Wagon**—A carriage on four wheels having no sides, and used for the transport of guns, mortars, traversing platforms, and for every description of heavy stores.

**Platoon** (French, *peloton*)—This word was used some centuries ago to represent a small body of musketeers, who were placed at the angles of a square of infantry, or were used as skirmishers. It also formerly signified a body of men who fired together in a volley.

**Plomb, To Strike**—In artillery, an expression made use of when a shot strikes an object direct.

**Plotting**—In surveying, transferring to paper the dimensions of the different angles and measurements made by a surveying instrument in the field.

**Plough**—A wooden wedge or shoe shod with leather. It is attached to a gunpowder incorporating mill, for confining the charge under the path of the runner. There are two attached to each pair of runners.

**Plug**—Anything used to stop an orifice or hole. In artillery material, there are a variety of plugs, which are chiefly required for the different natures of shells. There are two classes of plugs, known as *fuze-hole* and *loading-hole plugs.* They are made of gun metal.

**Plumes**—Feathers worn in the full-dress hats or helmets of staff officers and officers of certain regiments in the service.

**Plummer Block**—In machinery, the carriage or support for a bearing to turn in, which is generally made of gun-metal.

**Plummet**—A contrivance consisting of a line with a weight attached to it (a leaden ball generally) to regulate any work in a line perpendicular to the horizon; it is used by masons, carpenters, &c. Another application of the plummet is in laying a mortar; it is further used as a pendulum to indicate the time of flight of a mortar shell.

**Plunder, To,** *vide* Maraud, To.

**Plunging Fire**—When a battery is raised considerably above the object, so that the shot impinges at a great angle, and is buried without grazing, the fire is termed "plunging fire."

**Pluviometer**—A rain gauge; an instrument to measure the quantity of rain that falls. It usually consists of a metal funnel from 5 to 7 inches in diameter, the rain being collected in a glass bottle. This bottle should be placed in a small stand near the surface of the ground, to protect the bottle from the action of the sun. The amount of rain fallen in a given time is measured in a graduated glass-jar, one-tenth the area of the funnel, and so divided that every inch in depth of the tube shall indicate $\frac{1}{10}$ inch falling in the funnel. The amount of rain which has fallen can be measured by such an instrument to $\frac{1}{3000}$ part of an inch, or even less.

Another kind of rain gauge may also be adopted. It consists of a cylinder of copper or other metal, from 5 to 7 inches in diameter, and 30 inches long. A float, just so much smaller as to allow it to rise freely, is placed within the cylinder, and to the centre of the float an upright staff is attached, marked in inches and tenths of an inch, which, rising through a hole in the bottom of the funnel, indicates the depth of rain received into the gauge.

**Pneumatics**—The properties of air or fluids; a branch of hydrostatics.

**Pocket Ledger**—A small account-book with which a soldier is provided, and in which is inserted the monthly settlement of his accounts, having reference to his pay, the state of his savings-bank account, date of enlistment, &c. Commanding officers are to see that these books are kept with the utmost regularity, the officers commanding the company of the soldier being responsible that the book is kept correctly, his signature being a voucher for the same. This book is familiarly termed by the soldier his "Tommy Atkins" (*q. v.*).

**Point**—In geometry, is a quantity which has no parts, being indivisible. It is also a term frequently used in a military sense, as a spot from which troops are moved according to certain rules of drill, such as:—

*Covering point*, which in changes of position materially concerns the movement of one line with another.

*Intermediate point*, which is the point that lies between the spot marched from and the spot towards which a body is advancing.

*Point of alignment*, upon which troops are formed and dress by.

*Point of formation*, upon which they are formed.

A *strategical point* is a position held by troops in a line of battle, which may present *weak* and *strong* points; and it requires great ability and experience for a general to discover the weak points of an enemy's position, so as to enable him to throw all his strength upon it and defeat him.

Strong points are those which are naturally so, or made such by artificial means. Arms of precision have altered the tactics of attack on these points, as a general prefers turning them to attacking them in front.

**Point, To**—To lay a gun so as to hit the object, or to come as near it as possible.

In artillery, the term *pointing* or *to point a rope* is given to the mode of tapering one end of a rope so as to make it enter easily into a hole or block.

**Point d'appui** (French)—A fixed point of support in rear of the operations of an army, or on its flanks, such as a fortress or some convenient locality to resort to in case of necessity. A *point d'appui* is of great importance in military tactics. Few battles have been fought without making use of villages, hills, and even single trees as *points d'appui*. In changes of front, one flank, or part of the force, should be held securely appuyed. Artillery massed in batteries have also served as *points d'appui*, as instanced at the battles of Borodino, Ramilies, Hohenkirch, &c.

**Point of Impact**—That point or spot which a projectile first strikes on meeting an opposing body.

The method of finding the *point of mean impact* is described as follows in Lieutenant-Colonel Owen's 'Modern Artillery':—

"The horizontal distance of each shot upon the target from a fixed vertical base (generally one side of the target) is first found, and a mean horizontal distance obtained, by dividing the sum of the distance by the number of shot; the same process is followed to obtain a mean vertical distance from a fixed horizontal base (generally the bottom of the target). The intersection of the two lines drawn parallel to the bases respectively and at distances equal to the horizontal and vertical mean distances already found, gives what is termed the *points of mean impact*. The distance of each shot from the *point of mean impact* is measured; these distances are added together, and the sum, divided by the number of shot on the target, gives the *figure of merit*.

alf a diagonal is allowed for every shot at does not strike the target."

**Point-blank**—A gun is said to be laid int-blank when the production of its axis asses through the object to be aimed at; gun may therefore be "point-blank" ith reference to an object, and yet have everal degrees of elevation or depression ith regard to the horizon.

In the 'R. A. Institution Papers,' Colonel now Major-General) Lefroy shows that what is termed *point-blank range* is a misnomer. What is usually called *point-blank range*, viz. the distance at which a shot impinges on a level plane, when fired parallel with it, is nothing more than the range due to an *angle of elevation* equal to the angle subtended by the height of the gun from the point struck.

**Pointing Rods** — Pickets or rods of iron ⅝ inch round, and about 2 feet long, two of which are placed upon the epaulment of a battery in front of each mortar, by means of which, with the aid of a plummet, the mortar can be directed with tolerable accuracy upon the object to be struck.

The pickets are first lined upon the object; the plummet, which is in the hands of the laying officer, who stands behind the mortar, is made to coincide with them, and the mortar is then traversed until the line of the plummet covers the centre line on the mortar, which is denoted by a notch on the muzzle, and another behind the vent; a chalked line is generally drawn on the exterior surface of the mortar between these notches. In masonry works, they must be placed on a fir plank, and about 6 inches from each end. The plank should be fitted with a grummet or handle at each end. In earthworks, two ramrods will answer for pointing rods.

Davidson's collimator is a more convenient and truer way of laying a mortar than the mode described above.

**Points, Tactical,** *vide* Tactical Points.

**Poitrinal** — In ancient armour, the breast-piece which formed part of the harness of a war-horse in the middle ages.

**Pole**—That part of a carriage to which the wheel horses are attached. Poles were formerly used in the Indian artillery, but are now abolished, and shafts for horse draught alone used, as in the home service. For carts and all extra carriages drawn by bullocks, the pole is indispensable.

**Police, Military**—A few steady soldiers who are chosen from a regiment or regiments to maintain order and regularity within the lines of a camp or garrison. They are under the superintendence of the provost sergeant, and their number varies according to circumstances. When on duty, they wear a badge round their right arm marked M.P.

When an army is in the field, it is recommended that a troop of police should be attached to each division, and one to the head-quarters of each army corps, to preserve civil order as distinct from military discipline. . This body of men to be under the provost-marshal, who, during war time, is vested with exceptional powers.

**Poltroon**—A coward, a dastard, one who has no courage. The origin of this word is stated by some to come from the Latin *pollex truncus*, in consequence of the frequent instances of men cutting off their thumbs to disqualify themselves for military service. Others, however, derive it from High Dutch, *Polster*, a bed, from poltroons taking to their beds whenever any peril presents itself; or again from the Italian *poltrone*, a colt, because of that animal's readiness to run away.

**Polygon**—A plain geometrical figure having more than four sides. Every piece of ground to be fortified is surrounded by a polygon, either regular or irregular, upon the sides of which the work is constructed.

**Polygonal System**—Known also as the *caponier system*. One of the three systems adopted in permanent fortifications to afford flanking defence; it takes its name from the trace of the works having the form of a polygon, and the ramparts of the body of the place, instead of being formed into bastions, being placed on the sides of the polygon. The flanking defence is sometimes effected by projecting buildings, such as large towers or tower bastions, and sometimes by buildings of less relief, called caponiers (*q. v.*) and placed traversely in the ditch.

This system is stated to have been originated by an Italian, F. Martini, who lived in the fifteenth century. With certain modifications, it has been of late adopted in Germany, and has been found to possess many advantages, as compared with the bastioned systems. This system of polygons is also applied to lines in field fortification.

**Polygrooved** — Many-grooved. The term is applied to such rifled guns and small-arms as have a multiplication of grooves, such as the Armstrong gun and other arms.

**Poniard**—A small pointed dagger.

**Pontoon Train**—An equipment of pontoons, which is kept up in the corps of engineers; it consists of two troops, ready equipped for service. This train comprises the boats, carriages, and *personnel* for driving and forming the bridge. The train is in units of 100 yards of floating bridge, and carries trestles for each end, so as to be able to make a bridge over a river 120 yards wide. Each troop has 31 wagons. Each pontoon wagon carries one pontoon and 5 yards of bridge, and the boat-wagon carries one boat and 5 yards of bridge.

**Pontoons**—Constructions of metal or wood which are used in forming a bridge across a river for the passage of an army. They are either light open boats with flat bottoms, upon which a roadway of planks is formed, or cylinder-shaped, with hemispherical ends, such as General Blanchard's pontoons, which have been hitherto the pattern pontoons used in the British army, but have now been superseded by the *new pattern pontoon.* This pattern pontoon is a boat with similar-decked ends, and is partly decked at the sides, where eight rowlock blocks are fixed. The pontoon weighs, dry, about 7 cwt., and draws, when floating and empty, 2½ inches, and 6 inches when in bridge. It is made of Clarkson's material on light wooden frames, and in shape like scows. It measures 22 feet 6 inches over all in length, 4 feet in width, 2 feet 4 inches in depth, and weighs 850 lbs.

Each inch of immersion of these pontoons gives about 500 lbs. of buoyancy. The buoyancy is sufficient to admit of the passage of siege artillery and steam sappers.

**Poppet-head**—That part of a lathe which holds the back-centre, and can be fixed on any part of the bed. Boring-machines have a poppet-head.

**Portable Magazine**—A wooden box or metal-lined case covered with canvas, and of such size as to be easily carried in a battery from place to place when there is only one expense magazine for several batteries; but this would scarcely ever be the case in the future, as expense magazines in the present fortifications are provided in the proportion of 1 to every 4 or 5 guns, or in the case of very heavy guns, 1 to every 2 or 3.

**Portcullis**—A strong defensive framework of timber, hung in grooves within the chief gateway of a fortress; it resembles a harrow, but is placed vertically, having a row of iron spikes at the bottom, and is let down to stop the passage in case of assault.

**Portfire** — A composition of mealed powder, sulphur, and saltpetre, driven into a case of paper to fire the priming powder of a gun. Portfires were in general use before the introduction of friction tubes; since then they have been for the most part in disuse. There were four different kinds of portfires at one time in the service, viz. the miners', *slow*, *blue*, and *common;* the latter was the portfire used for igniting the charge of a gun; the first three have become obsolete.

The *common* portfire is 16 inches long, and burns at the rate of 1 inch in a minute.

**Portfire Socket,** *vide* Socket.

**Portion,** *vide* Gun and Mortar Portion.

**Position**—In a military sense, is a place which is either weak or strong according to its nature and state of defence, and is or may be held by a force on a field of battle, such as a hill, village, building, &c. Rivers, morasses, woods, are also considered as positions if covering the front of an army or enabling its wings to rest upon them. Each position has some point or points called the key or keys of the position (*q. v.*).

The expression "taking up a position" means the act of occupying ground by a force.

The selection and occupation of a military position belong to strategy and the higher branches of tactics, and requires great experience in the field.

Military positions are either *defensive* or *offensive.* In either case, they must be hosen with reference to the position of he enemy, and must command the approaches to the position in the first case, and the *débouchés* from the position in the second.

If they present any weak points, these must be strengthened by means of fieldworks, &c. (*Vide* Reconnaissance.)

**Position, Batteries of,** *vide* Batteries of Position.

**Post**—A soldier's beat while on sentry, or a position assigned to or taken up by a soldier or body of men; it generally consists of an entrenched village or position, or any building placed in a state of defence.

The necessity of strengthening a post is admitted to be of paramount importance, and every endeavour should be made by the officer in command to place himself in such a defensive position as shall prevent his being taken unawares, or, if attacked, enable him to make a good fight of it. Often neither time, material, intrenching tools, nor men will permit of solid works, such as a redoubt or other elaborate fieldworks, being thrown up, but it is possible, when villages or detached houses are occupied by troops, to throw up temporary cover which shall greatly strengthen the position. The mode of carrying out such a system of defence should be known to every officer in the army.

The following are the principles to be borne in mind in forming a military post or in strengthening a position, extracted from the 'Instruction in Military Engineering':—

"1. To obtain cover for the men from the enemy's fire.

"2. To enable the troops to fire, in the most advantageous manner, on the ground over which the enemy must advance.

"3. To hinder the approach of the enemy by obstacles, which, even if surmountable, shall be sufficient to break his order and detain him for some time under fire.

"4. To enable the troops to pass freely from one part of the works to another, in order to concentrate on any point attacked.

"5. To impede the flank movements of the enemy as much as possible, and thus prevent his different parties from supporting each other effectually."

To give one example of the value of a military post, the following is related:—"If an example be required of the practical benefit of a military post, it is to be found in the case of Hougomont, a fortified farmhouse in front of the position at Waterloo, which baffled the repeated efforts of the French to take it throughout the whole of the battle." (*Vide* Outposts and Advanced Posts.)

The term *post* is given to the bugling which precedes the tattoo. This is the *first post*, the *last post* that which follows it.

**Postern**—In permanent fortification, a vaulted passage of masonry constructed underneath the mass of the rampart, generally leading from the interior of a work to the ditch. In a bastion front it is constructed under the middle of the curtain. Posterns are usually 8 feet wide, and 10 feet high at the crown of the arch, and are closed at each extremity by doors.

**Post-office**—A place in which letters are received, and from which they are despatched. In armies in the field, a regular post-office is organised under an officer named for that purpose, who is assisted by a staff of men, probably the police of the army. In military stations, the delivery of letters, when the barracks are within the limits of the post-office, is made by the postmaster, provided the commanding officer prefers that mode; otherwise, special arrangements are made for their delivery, generally in a non-commissioned officer being sent to the post-office.

**Pot**—In ancient armour, the *pot* was an iron hat with a broad rim. It resembled the morion.

**Potassa,** *vide* Saltpetre.

**Potassium,** *vide* Chloride of Potassium.

**Pouch, Small-arm**—A leather case lined with tin for carrying a soldier's ammunition; it has a flap buttoned down, which protects the ammunition from rain getting into the case. Infantry pouches contain 40 rounds, artillery 20 rounds; but the soldier in the former service takes besides 10 in expense bag and 20 in valise, the reserve of 30 rounds being carried in the regimental ammunition wagons, so that there will be with the battalion 100 rounds per man. In the manufacture of pouches, buffalo hide is generally used.

**Pounce**—Gum sandarac powder; when formed into paste, it is used in public offices as an adhesive for letters.

**Pounder**—The name by which different natures of ordnance and shot and shell are distinguished. By being so denominated, the weight of the projectile which the gun throws is implied. Projectiles fired from heavy howitzers and mortars are distinguished by the diameter of the pieces, such as those propelled from the 10-inch and 8-inch howitzer and mortar; and it would be advisable to denominate all projectiles by the diameter of the piece, and also by the weight of the projectile itself. This is done in the case of shot and shell used with the heavy M.L.R. guns of 7-inch calibre and upwards, but below this calibre they are known only by the weight of the shot. The weight of heavy rifled ordnance is always expressed in tons, if of 5 tons or upwards; otherwise in cwts.

**Pourpoint**—A military habit worn in the thirteenth century, but which was subsequently modified, and from the peculiar work with which it was then ornamented obtained the name of *pourpoint* or *counterpoint*. A complete suit, consisting of a sleeved tunic and *chausses*, was frequently worn by the knights of this period beneath the surcoat, which was considerably lengthened, and emblazoned with the arms of the wearer.

**Powder** — A common term for gunpowder (*q. v.*). Under this name is found a variety of powders in use at the present day for small-arms and guns, either in England or on the continent.

The cannon and small-arm powders used in the British artillery are *pebble*, *rifle large grain*, *large grain*, and *rifle fine grain*, technically known as P., R.L.G., L.G., R.F.G. and R.F.G.$^2$.

The following table gives the proportions of the composition used in the manufacture of gunpowder in the countries mentioned below:—

| COUNTRIES. | GUNPOWDER. | | | SMALL-ARM POWDER. | | |
|---|---|---|---|---|---|---|
| | Saltpetre. | Charcoal. | Sulphur. | Saltpetre. | Charcoal. | Sulphur. |
| America .. .. .. | 75 | 12·50 | 12·50 | 75·50 | 13·20 | 11·30 |
| Austria .. .. .. | 70 | 17 | 16 | 75·50 | 13·20 | 11·30 |
| England .. .. .. | 76 | 15 | 10 | 76·50 | 14·50 | 9 |
| | 76 | 14·50 | 9·50 | 76 | 13·50 | 9 |
| France .. .. .. | 75 | 14·50 | 9·50 | 75 | 12·50 | 12·50 |
| Germany .. .. .. | 75 | 13·50 | 11·50 | 75 | 12·50 | 12·50 |
| Italy .. .. .. | 76 | 12 | 12 | 75·50 | 13·20 | 11·30 |
| Russia .. .. .. | 71 | 17·50 | 11·50 | 80 | 11·30 | 8·70 |
| Spain .. .. .. | 76·50 | 12·70 | 10·80 | 75·50 | 13·20 | 11·30 |

**Powder Barrels,** *vide* Barrels, Powder.

**Powder Hides,** *vide* Hides.

**Powder, Horsley,** *vide* Horsley Powder.

**Powder Hose,** *vide* Hose, Powder.

**Powder Magazine**—A receptacle for the storage of gunpowder. The 'Aide-Mémoire to the Military Sciences' affords the following information on magazines:—"A gunpowder magazine should be built with reference to the object required, *whether* as storage after manufacture, or the supply of an armed place such as a fortress. In the latter case, it should be bomb-proof and capable of holding 1000 barrels. In fortified places, such as large fortresses, it is considered convenient to place the magazines in detached parts of the fortification, such as the centre of empty bastions, or open spaces within the enceinte. Powder magazines are usually provided with double doors and window shutters, which are made of thick materials and covered with copper. The air holes, both inside and out, are covered with copper, and copper plates having a great number of small holes perforated in them. No iron or steel is ever permitted in the construction of powder magazines. Sometimes magazines have been formed with groined arches, that is to say, with two sets of arches of equal height, or nearly so, intersecting each other at right angles. In this method there is a saving of materials, and a greater interior space may be gained, because, instead of intermediate pier walls extending in a continued line from one end of the magazine to the other, as in the former construction, there are only small pillars of about 4 or 5 feet square at the utmost, which may be placed at considerable intervals apart, and from which the groined arches spring in contrary directions. This construction has, however, been seldom used, being less simple and weaker than the former mode. With respect to the roof of magazines and other bomb-proofs, which are not covered at the top with some feet of rubbish, like those of casemates, it is prudent on that account to add to the thickness of masonry, in order to make them equally secure against shells, but the same precautions against damp are unnecessary, for the common slates or tiling, &c. used in dwelling-houses are quite sufficient, provided that the ridges and gutters are leaded. Much depends upon the pitch of the roof, which ought to be rather steep than otherwise."

Powder magazines built for the storage and preservation of powder in time of peace should be kept separate from each other and surrounded by high mounds of earth ; they should each be capable of holding 4000 or 5000 barrels, or even more.

Gunpowder is stored in barrels which are placed in racks, or bays in some magazines ; in others, the barrels are piled pyramidally from the floor upwards without any support. In all powder magazines one of the racks should be left empty for the sake of shifting the powder, or the barrels may be rolled in their own compartments, which would answer the purpose. During the dry season in India, magazines may be opened daily to air, *if necessary*, but during the rains they should be kept closed, until a break in the weather takes place, when advantage should be taken of a dry day to open them.

The following memoranda respecting the ventilation of powder magazines is herewith appended, being the instructions issued by the War Office for the guidance of officers in charge of magazines :—

"1. The dampness complained of in buildings will frequently be found to arise from condensation of the watery vapour of the air which enters the building. Buildings with thick walls and vaulted roofs, and especially those covered with earth, are particularly liable to dampness from this cause.

"2. Air always contains some proportion of watery vapour. When the proportion is small, the air is said to be dry, and when large, the air is said to be damp ; when the proportion is the greatest that can be diffused through air at a given temperature, the air is said to be saturated at that temperature.

"3. The proportion of watery vapour which saturated air contains varies with the temperature, being greater for high than for low temperatures. Air containing a particular proportion of moisture is rendered less capable of depositing moisture by its temperature being raised, and the reverse when it is lowered.

"4. Air may be brought to a state of saturation by reducing its temperature. If the air contain but little moisture, the reduction of temperature must be considerable ; but, if it contain much, a slight reduction will bring it to a state of saturation.

"5. If air be cooled below the degree of temperature at which it will be in a state of saturation, a portion of the watery vapour contained therein will be deposited on any cold substance with which it may come in contact. The degree of temperature at which air will thus begin to deposit moisture is called its *dew-point*.

"6. When warm air enters a comparatively cold building, the temperature of the air is reduced by coming in contact with the interior walls and other cold surfaces ; and if its temperature be thus reduced below the dew-point, condensation will take place. In the latter case it is obvious that the admission of fresh air will not tend to dry a building, but to render it damp.

"7. If a magazine 40 feet by 24 feet by 12 feet, the temperature of whose internal walls, &c. is 45°, were to be filled with saturated air having a temperature of 50°, and the magazine were then closed, nearly a pint of moisture would be deposited during the cooling of the fresh air to the temperature of the walls. The pint of moisture would result from the quantity of air sufficient merely to fill the magazine; but if the ventilators were open, the air might be renewed many times in the course of a day, and very much more than a pint of moisture be deposited.

"8. Air entering a building whose temperature is higher than its own becomes capable of absorbing moisture from damp surfaces.

"9. The efficiency of the ventilation of a magazine will depend upon the degree of dryness which the fresh air admitted into it possesses, and the rapidity of the current of dry air passing through the building.

"10. The dryness of air is indicated by the number of degrees by which its temperature exceeds its dew-point.

"11. The ventilators of magazines should, in all cases, be constructed so as to exclude or admit the external air at discretion, *and the instructions for their use should be framed with a view to the exclusion of the external air when the temperature of its dew-point is above that of the interior of the building, and the admission of the air when its dew-point is below the temperature of the interior of the building.*

"12. For the foregoing reasons, the common practice by which, under art. 491, 'Ordnance Regulations,' 1855, magazines are open for purpose of ventilation on 'every *fine* day,' is considerably modified.

"13. The interior of a bombproof magazine with thick walls and a vaulted roof is commonly colder than the outside air in summer and warmer in winter. Winter is therefore the more favourable season for ventilation; but in the climate of England the exceptions to this rule are numerous, owing to the prevalence during winter of warm damp winds from the south and west, and during summer of cold dry winds from the north and east.

"14. Whenever, notwithstanding a careful attention to ventilation, magazines are found to be damp, their condition may be improved by the use of quick-lime, which has the property of absorbing from the air about one-third of its own weight of water.

"15. The proper time for using lime is when the condition of the magazine would not be improved by ventilation, and when, consequently, the ventilators are closed. . Lime would be of very little service while a rapid current of air was passing through the building.

"16. Lime will be used during the seasons of the year least favourable for ventilation in all magazines that show signs of dampness.

"17. The lime should be fresh from the kiln, broken into lumps not larger than about the size of a pigeon's egg, and exposed to the air of the interior of the magazine in shallow vessels. It should be kept in air-tight casks until spread out for use."

**Powder Mills**, *vide* Mills, Powder.

**Powers, Mechanical**, *vide* Mechanical Powers.

**Pozzuolana**—A volcanic sand brought from Italy; it forms a cement which hardens under water, and thus makes the best mortar for the piers of bridges. In India a mortar is made having similar properties, and called *soorky* (*q. v.*).

**Practice**—Habit; dexterity; frequent use; the carrying out what theory teaches. In the instruction given to officers and soldiers in the use of their arms, the term *practice* is familiarly known under the name of musketry, gun, and mortar practice. The name is also given to such practice as the autumn manœuvres afford, fitting the soldier for actual warfare.

For the course of practice carried on with small-arms, *vide* Musketry; and for that of artillery, *vide* Shoeburyness.

**Precedence**—The relative rank of men and women in society; strictly, it means the order, as shown in Brande and Cox's 'Dictionary,' in which they follow one another in a state procession, which it is

f the office of herald's duty to
in and preserve.
precedence of the officers of the
ollows that of the navy, according
comparative rank and length of

following is the order of prece-
f the several regiments and corps
Majesty's service, viz.:—
The regiments of life guards, and
al regiment of horse guards.
The royal horse artillery; but on
with their guns, this corps will
e right, and march at the head of
sehold cavalry.
The regiments of cavalry of the
cording to their number and order
dence.
The royal regiment of artillery.
The corps of royal engineers.
The regiments of foot guards.
The regiments of infantry of the
cording to their number and order
edence.
The departmental corps.
royal marines, when acting with
ops of the line, take rank next to
h regiment.
rifle brigade ranks next to the 93rd
nt.
militia regiments have precedence
those of the line, according to
respective numbers as fixed by
When regiments of British and
ilitia of the same arm are serving
r, the militia of that part of the
Kingdom in which the regiments
the time be quartered has pre-
over other militia, but regiments
llery militia always have prece-
over the infantry militia.
arade, for purposes of manœuvring,
are to be distributed and drawn
the mode which the general or
fficer commanding may judge most
ient, and best adapted to the pur-
of the service. Rifle battalions
be formed up on a flank.
**ipitation**—In chemistry, is most
ntly employed for the separation
stances from each other. This
ion consists in the conversion of
nstituent part of a liquid into a
rm, when it may be separated by
nical means; this may be effected
nging either *the chemical nature* of the constituent to be separated or that of the liquid in which this constituent is dissolved.

**Precision**—Exactness; accuracy; scrupulous observance of certain given rules. In military phraseology, this term is often employed when remarking on the drill or marching of a regiment. The term is also applied to rifled arms under the name of *arms of precision* (*q. v.*).

**Precision, Measure of,** *vide* Measure of Precision.

**Preliminary** — Introductory; that which precedes the principal course of business, and in military language is applied generally to drill.

As a substantive, the term *preliminary*, in its plural sense, signifies an introductory measure, such as the *preliminaries of peace*.

**Premature Explosions of Shell,** *vide* Lacquer, Black Lead.

**Preponderance**—In artillery, the excess of weight of a gun in rear of the trunnions. As applied to modern guns, it is the pressure which the breech portion of the gun, when horizontal, exerts on the elevating arrangement. A certain amount of "preponderance" is necessary in all guns, in order that they may rest steadily on their carriages, but it is desirable that it should be as small as possible, to enable heavy guns to be elevated or depressed without difficulty. The preponderance varies in different guns in the service, in smooth-bore guns between $\frac{1}{9}$ and $\frac{1}{13}$ of the total weight of the piece. In M.L.R. guns of the heavier natures, such as the 9-inch, 8-inch, and 7-inch, the preponderance is between 5 and 6 cwt.; in guns of 18 tons and upwards, it should not exceed 3 cwt.

**Preservation of Iron Ordnance**—The act of preserving iron ordnance from rust or corrosion. Great attention should be paid to this duty. With smooth-bore ordnance, the first step to be taken is to clear the bore and exterior surface from rust and dirt; the inside is cleansed with circular spring scrapers, fixed on the end of a long shaft; they are made to press on the sides of the cylinder, and by being drawn backwards and forwards will restore a regular smooth surface; the end of the bore is also scraped with a tool for that purpose. The vent is opened by turning a square steel rimer through it, until it is clear. The bore is then brushed out with a hard round brush, and then with a *turk's-head* brush, so that no residue is left. This done, a coat of lacquer is to be laid on; and when dry, a second is added, which is performed by a common paint brush fixed vertically on the end of a staff long enough to reach down the bore; the bottom of the bore is lacquered by a brush attached horizontally to the end of the staff. The outside of the piece is to be well scraped with a tolerably sharp steel tool; about the mouldings where former coatings have collected, and where the rust will not give way, it should be slightly hammered, so as to loosen it. The pieces should not be removed until the paint is quite dry. The painter should mark the date, to show how long the lacquering lasts.

Where anti-corrosion paint was formerly used for lacquering the exterior and bores of guns, *Pulford's magnetic paint* (*q. v.*) is now used.

In the preservation of rifled ordnance, the following is directed for their care. The bores of guns to be lacquered; 20-pr. B. L. guns and upwards are painted on the exterior with one coat of Pulford's magnetic paint, but all other wrought-iron field guns are bronzed only.

The exposed gun-metal portions are "bronzed," the steel parts are "blued."

**Press, Hydraulic,** *vide* Hydraulic Press.

**Press-cake,** *vide* Cake, Press.

**Pressure Gauge,** *vide* Gauge, Pressure.

**Pressure of Atmosphere,** *vide* Atmosphere, Pressure of.

**Preventor Ropes**—Ropes used in the artillery service to check any motion which is liable to become too rapid, such, for instance, as the recoil of a gun.

**Primers**—In the artillery service, are tubes of leather paper 2¼ inches long, driven with mealed powder, and pierced like a friction-tube; they are used, when required, with the 40-pr. and 7-inch B.L.R. guns, and are placed in the horizontal part of the vent piece before it is placed in the gun, to communicate the flame from the friction tube to the cartridge. The length and form of the vent holes in these guns are such that the friction tube alone will not always readily ignite the cartridge. *It is stated*, however, that it is very *seldom* necessary to use them.

A primer is issued with Boxer's Shrapnel shell for rifled guns. It is used for the purpose of securing the bursting charge, and to give greater regularity to the bursting of the shell.

**Priming of a Gun**—The powder poured into the vent of a gun, with the view of its communicating with the cartridge. This mode of priming was the usual method before the introduction of friction tubes, and when the priming was ignited by means of a portfire.

In the preparation of fuzes, carcasses, &c. a priming is used to assist in igniting them. For M.L.R. field guns, gun-cotton priming has been introduced for use with shells when firing at high angles with small charges, as the quick-match often fails to ignite the shell.

**Principals**—The sloping beams of a roof. (*Vide* Tie-beam.)

**Pripole,** or **Prypole**—The front leg of a gyn.

**Prism**—In mathematics, a solid whose bases or ends are parallel plane figures, and whose sides are parallelograms.

In artillery, a rectangular block bevelled on either side of the upper surface; it is used for raising a gun out of the trunnion holes when a short skid cannot be got under it.

**Prismatic Compass**—A surveying instrument, by means of which horizontal angles can be observed with great rapidity, and, when used with a tripod stand, with a considerable degree of accuracy. It is a very valuable instrument to the military surveyor, who can make his observations with it, while holding it in his hand, with all the accuracy necessary for a military sketch.

**Prismatic Powder**—Powder formed into discs and perforated.

**Prisoners of War**—Soldiers captured from the enemy, or such who, during military operations, have surrendered themselves, finding that any further opposition is useless. Civilisation has so far changed all the extreme measures of warfare that pains and penalties are seldom exercised towards those whom misfortune has placed in an adverse position. In fact, the sympathy of the conquerors is such that kindness is the prevailing feature towards prisoners of war, and humanity bids that it should be so, seeing with what brave adversaries armies have to deal.

**Prisons, Military**—Places of confinement for soldiers undergoing long sentences by courts-martial. There are altogether six military prisons in Great Britain and Ireland—at Gosport, Millbank, Greenlaw, Cork, Dublin, and Limerick. There are besides, in various parts of our colonies, six other similar establishments—at Barbadoes, Gibraltar, Halifax, Malta, and the Mauritius. In India there are also military prisons in the different presidencies.

**Private**—A term used in the British infantry to express a soldier in the ranks. A corporal, though numbered among the rank and file, does not come under the denomination of *private*.

**Prize Agents**—Officers belonging to an army in the field, who are chosen after a campaign to collect all property belonging to the enemy which has fallen into the hands of the victors. If the prize property be considerable, it is a lucrative position, as a certain percentage on what is collected is granted to the prize agents. (*Vide* Prize Money.)

**Prize Money**—Is the value of the property captured from the enemy after its realisation by sale. To carry out the rules having reference to prize property, prize agents are appointed, selected by the army, to collect all property which has been captured in each of the towns and fortresses through which the conquering army has passed. No oppression is permitted in the matter; all that is demanded is that what, by the rules of war, falls to the possession of the captors be given up. Such property is sold, and finally divided among the army.

**Probable Rectangles**—This term has reference to the method of comparing the shooting of different guns, as proposed by Captain A. Noble, F.R.S., late R.A. The calculations involved will be found in vol. viii. No. 7 of the 'Royal Artillery Institution Papers;' in the same papers, Captain W. H. Noble, R.A., gives the following definition of the term:—

"The 'probable rectangle' represents an area on the horizontal plane, within which there is an even chance of any one shot falling; that is to say, the area would probably contain half the number of shots fired. The smaller the rectangle, therefore, the greater the accuracy of the shooting. The length of the probable rectangle depends upon the value of the 'mean difference of range;' the breadth upon that of the 'mean reduced deflection,' or—

$$\text{“}\textit{Length} = \frac{\text{sum of differences of range from mean range}}{\text{one less than the number of shots}} \times \text{constant.}$$

$$\text{“}\textit{Breadth} = \frac{\text{sum of differences of deflection from mean deflection}}{\text{one less than the number of shots}} \times \text{constant.”}$$

**Profile**—If a plane pass through a work in any direction, and the cut made be vertical and perpendicular to the face of the work, it is a *profile*.

**Progress Report**—A weekly report of the progress of a regiment or detachment on the march, accompanied by a *present state*; it is sent to the quartermaster-general of the division in which the troops may be, and to the quartermaster-general of the army. These reports are only now required in India.

**Projectiles** — Blocks of metal of different shapes and sizes, which, when introduced into guns and small-arms, can be projected by means of a charge of gunpowder, at varying distances, for the purpose of causing destruction in the ranks of the enemy or in his works of defence.

Projectiles must offer two particular conditions: first, they should be of a weight and shape capable of facilitating their range and direction; secondly, if a shell, to be so constructed as to be capable of bursting at a given time in one or more fragments. For small-arms, they are commonly designated bullets, and for guns, shell, shot (round or elongated), canister shot, &c.

*Round* or *spherical* projectiles are only used with smooth-bore guns.

*Elongated projectiles*, with rifled guns; they present the following advantages:—

(1) The head may have any shape, ac-

cording to the purpose for which the projectile is required.

(2) The capacity of the projectile for powder or bullets is increased.

(3) Percussion fuzes may be made of a more simple character, as it is only necessary to provide for action in one direction.

(4) The weight of the various projectiles fired from the same gun may be assimilated by varying the length.

(5) A great saving of powder is effected. (*Vide* Appendix B.)

**Prolonge**—A four-stranded rope, upwards of 1 inch in diameter, and 72 feet in length, with which field artillery is provided, to enable it to fire while retreating, without the necessity of limbering and unlimbering. It is rarely of any value.

**Promotion**—The act of promoting. In matters appertaining to the army, the advancement of an officer or soldier to some higher rank in his regiment, or higher place in a department, is understood as *promotion.* Regimental promotion among officers was, up to within a few years, carried on by purchase (*q. v.*) in the cavalry and infantry, but promotion is now regulated by efficiency and selection.

The rules which regulate the promotion of officers in the auxiliary forces will be found in the circular of May 1874 for that body of men. (*Vide* Appendix A.)

**Proof** (Latin, *probo*, I try or test)—A test; the degree of strength of anything, whether it be capable of bearing what is stated. The term, in military matters, is well known in conjunction with the material of war, such as the *proof of gunpowder* (*q. v.*), *ordnance*, &c.

**Proof of Gunpowder**—A process pursued in testing gunpowder as regards its quality, strength, and uniformity. The quality is ascertained, both small and large grain, by its general appearance, its firmness, glazing, uniformity of grain, and density; its strength and uniformity, as explained further on. The weight of a cubic foot of government powder varies according to the nature of the powder. The process of *flashing* is also resorted to for testing the cleanliness and intimate mixture of the ingredients. With this view, about 3 drachms of powder are placed on a glass plate, and fired with a red-hot iron, when, if the powder has been properly made, no residue or foulness should be left. In addition to the above proof, the hygrometric test is a very necessary one to be taken of all natures of powder.

The usual mode adopted to test the explosive strength or pressure of gunpowder in a gun is thus explained:—"An 8-inch proof gun is fitted with 3 screw gauges, or 'crushers,' by which the pressure of the exploding charge is recorded at three points in the bore, namely—in the axis by a gauge screwed through the cascable of the gun; by a gauge, screwed into the side of the gun at 7¾ inches from the end of the bore; and by a gauge screwed into the side of the gun at 15½ inches from the end of the bore. The velocity of the shot, or cylinder, is measured by two Navez-Leurs' or Boulengé's chronoscopes. For this purpose four wire screens are arranged in front of the gun at the respective distances from the muzzle of 90 feet, 100 feet, 210 feet, and 220 feet. Nos. 1 and 3 screws belong to No. 1 instrument, Nos. 2 and 4 screws to No. 2 instrument. The velocity of each projectile is, therefore, registered at two points in front of the gun, namely, at 150 feet and 160 feet, by two independent instruments.[*] This affords a complete check on the method of recording the velocity. The 'crusher' gauge, or instrument for measuring the pressure caused by the explosion of the charge, consists of a screw-plug of steel, provided with a movable base which admits of the insertion of a small copper cylinder, ½ inch in length, into a chamber. One end of this copper cylinder rests on an anvil, while the other is acted upon by a movable piston. The copper cylinder is centred in the chamber by a small circular watch spring.

"The action of the apparatus is as follows. Upon the explosion of the charge, the gas, acting on the area of he piston, one end of which is almost lush with the interior of the bore, rushes the copper cylinder against the anvil. The amount of compression which the copper thereby sustains becomes an indication of the pressure. The area of the copper cylinders used for proof of gunpowder is $\frac{1}{12}$ square inch, while the area of the piston is $\frac{1}{8}$ square inch. To form a table of pressures, a series of experiments has been carried out in a testing machine, so as to determine the pressure required to produce a definite amount of compression in copper cylinders corresponding to those used in the instrument. The tabulated results furnish a means of comparison whereby the amount of compression produced in the 'crusher' becomes a direct indication of the pressure at that part of the bore where the plug is inserted. The interesting experiments carried out by the committee on explosives have shown that the pressure indicated by each 'crusher gauge' is, practically speaking, a true measure of the strain on the gun at that point.

---

[*] The instrument records the time the projectile takes to pass over the space included between the two screens; the observed velocity, therefore, is at a point midway between the screens.

"The *modus operandi* of conducting an individual experiment in connection with the proof of gunpowder is as follows. The electric batteries and wire screens for use with the chronoscopes having been duly prepared, and the operator having satisfied himself that the instruments are in thorough working order, the command is given to "load." Upon this the men at the gun insert a cartridge of 35 lbs. weight and 19 inches length into the bore, and ram it home until a stopper on the stave of the rammer comes in contact with the face of the muzzle. The cylinder, flat at both ends, is then inserted and rammed home in a similar manner. This proceeding ensures uniformity, as, owing to the stops on the rammer staves, each charge occupies the same space in the bore. The 'crusher' plugs are then screwed into their respective holes, the copper cylinders having previously been fitted into the chamber in the extremity of the plug. All is now ready. The operator adjusts the chronoscopes, and gives the signal to fire. The projectile passes through the wire screens before it buries itself in the *earth butt* at which it is directed. The operator notes the readings of the instruments. The 'crusher' plugs are withdrawn, and the little copper cylinders removed, stamped with the experimental number of the series, and measured in a callipers or micrometer gauge. A reduction in the length of the copper cylinder of $\frac{1}{10}$ inch indicates a pressure of 12 tons on the square inch; of one-tenth and a half, of sixteen tons; of $\frac{2}{10}$, of 21 tons; of $\frac{3}{10}$, of 36 tons, &c. Thus the operator, in each round, records two velocities, which ought to be almost equal, and pressures at three points in the bore. Let us assume that the pressures at the three points are respectively 17·6 tons, 17·9 tons, and 16·3 tons, and that the observed velocities per second are 1430 and 1426 feet at the respective distances of 150 feet and 160 feet from the muzzle. As a flat-headed cylinder of 180 lbs. weight and 8 inches in diameter, travelling at 1400 feet a second, would, owing to the resistance of the air, lose about 15 feet velocity in passing over 150 feet of space, the mean velocity at the muzzle will be 1443 feet. This batch of powder, therefore, would have passed proof within the terms of the specification. Had, however, the pressure recorded at any one point exceeded twenty tons, or the observed velocities been less than about 1405 feet, or greater than about 1465 feet, the powder would be rejected."

The instrument invented by Le Boulengé, for proving powder, has now nearly superseded that of Navez-Leurs, both in India and in England.

A very valuable paper on "Fired Gunpowder," by Captain A. Noble (late R.A.), F.R.S., and Professor Abel, F.R.S., will be found in the 'Philosophical Transactions of the Royal Society' for the year 1875, in which is given the result of certain experiments for ascertaining the different phenomena of fired gunpowder within the bore of a gun, a subject until very lately veiled in obscurity for want of suitable instruments and data on which to carry out the experiments. The different chronographs which have been invented give us the measure of velocity of a projectile at the muzzle of a gun and during its flight, but the velocity of a shot within the bore from its first movement, along certain fixed points, until it leaves the gun, has been left to Captain Noble to discover with his beautiful chronoscope, which is able to record the millionth part of a second. This instrument, in conjunction with the "crusher gauge," enables us to ascertain all the phenomena attending the combustion of gunpowder, such as its tension or pressure—its rapidity of ignition—the time occupied in burning different natures of gunpowder, &c. The subject is so interesting that it cannot fail to attract the attention of all scientific men and that of the practical artillerist.

The length of the memoir prevents, in a work of this sort, a longer allusion to the results of the experiments than is now given.

**Proof of Ordnance**—The test ordnance is put to after being manufactured. The proof of rifled guns is carried out as follows, as described in Captain Stoney's paper " On the Construction of our Heavy Guns ":—

" Gutta-percha impressions are taken of the whole length of the bore in the four quarters. The gun is then proved with two rounds—the projectile being equal in weight to the service one, but flat-headed for 7-inch guns and upwards, in order that it may penetrate as little as possible into the butt, and the charge being 1¼ the weight of the battering or highest charge used in the service. The gun is fired in the open by means of an 'Abelic' electric tube connected with a magneto-electric battery in a bomb-proof shed. After proof, water is force-pumped into the bore, with the pressure of 120 lbs. to the square inch. This was instituted for guns with wrought-iron barrels to ascertain that the breech was perfectly closed, and is still continued in the case of solid-ended steel barrels, to make sure that the end has not been split in proof. After this the gun is cleaned, and gutta-percha impressions of the bore being taken as before, the two sets of impressions are compared to ascertain that no flaw of a serious character has been developed by proof. If any defect appears of which there is even the slightest doubt, the gun is subjected to *five* more rounds with service charges, and if after that the flaw does not appear to have increased, the gun is passed."

For the future, the proof of guns firing pebble powder is to consist of one round with battering charge, and two with proof charges, all three with service weight of shot.

**Prosecutor**—On a court-martial, the person who originates the charge, the prisoner's commanding officer, or a staff officer, may be ordered to perform the duty; in inferior courts the adjutant of the prisoner's regiment is usually the prosecutor; in all cases the official prosecutor must be subject to military law. If an officer is to be called as a witness, he ought not to be detailed, if possible, to act as prosecutor. In former days it would appear that the major of a regiment discharged the duty of prosecutor.

**Protection**—The act of protecting, defending, or covering.

This term is applied in a general sense in the case of natural or artificial defences thrown up for the covering of a body of troops, or the defence of a weak position for their protection against the enemy's fire.

Protection is afforded to the men in the field by any hasty earthworks thrown up for that purpose, such as shelter trenches, pits, &c.; in forts, by screens placed in front of the embrasures called mantlets (*q. v.*); in siege operations, as the formation of a sap, &c., by fascines, gabions, &c.

In skirmishing, men are taught to make use, as a means of protection, of every tree, ridge, ditch, hedge, in fact any available cover.

**Protractor**—In surveying, an instrument for laying down on paper the angles taken in the field.

**Protractor, Semi-circular**—An instrument used for measuring the inclination of the vent of a piece of ordnance.

**Provisions**—The term *provisions*, in a general sense, includes all articles provided for the daily wants of the soldier and the cattle of an army; known also under the name of rations (*q. v.*). Provisions vary in quantity and quality depending on circumstances.

**Provost Marshal** — A functionary vested with powers of a special and xtraordinary nature, the offspring of he exigencies of armies in the field. The Articles of War lay down the duties of provost-marshals in the following terms:—

"For the prompt and instant repression of all irregularities and crimes abroad which may be committed by troops in the field and on the line of march, provost-marshals shall be appointed by us, or by our commander of the forces, or general commanding, and their powers shall be regulated according to the established usages of war and rules of our service, being limited to the punishment of offenders whom they may detect in the actual commission of any crime;—the general commanding our forces in the field will cause them to exercise the powers entrusted to them in such manner and under such circumstances as he may consider best calculated to prevent and instantly to repress crimes injurious to the discipline of our army and the public service;—their duties are to take charge of prisoners confined for offences of a general description;—to preserve good order and disciple;—to prevent breaches of both, by soldiers and followers of the army, and to punish on the spot, or the same day, those whom they may find in the immediate act of committing breaches of good order and military discipline;—provided that the punishment be limited to the necessity of the case, and shall accord with the orders which the provost may from time to time receive from our commander of the forces in the field, and that whatever may be the crime, the provost-marshal or his assistants shall see the offender commit the act for which summary punishment may be inflicted, or if the provost-marshal or his assistants should not see the offender actually commit the crime, but that sufficient proof can be established of the offender's guilt, a report shall be made to the commander of our army in the field, who is hereby empowered to deal with the case as he may deem most conducive to the maintenance of good order and military discipline."

**Provost Prison Cells**—Military prisons, garrison or regimental, for the confinement of soldiers summarily awarded imprisonment by authority of the commanding officer, as well as for carrying into effect the sentences of imprisonment by courts-martial, for periods not exceeding forty-two days.

**Provost Sergeant,** *vide* Sergeant.

**Prussian Rifled Gun,** *vide* Krupp Gun.

**Prypole,** *vide* Pripole.

**Public Accounts,** *vide* Accounts, Public.

**Puddling**—In metallurgy, a process in the refining of iron which consists in stirring the metal actively about, when in a state of fusion.

**Pukhal** (Sanskrit, *pai*, water; *khāl*, hide)—An Indian term for a leathern water-bag, commonly carried on the back of a bullock or mule.

**Pulford's Magnetic Paint**—A paint now universally used instead of anti-corrosion paint for lacquering iron ordnance and projectiles. It is an oxide of iron. This paint is called "magnetic" from the property of being attracted by a magnet.

**Pulley**—One of the six mechanical powers. It is described as follows:—"The pulley is a small wheel movable about an axis passing through its centre; in the circumference of the wheel is a groove to admit a rope or flexible chain. Pulleys are of two kinds, fixed and movable, according as their axes are fixed or movable. In the fixed pulley, the power is equal to the weight. In the movable pulley, the power is to the weight as the radius of the pulley is to the chord of the arc enveloped by the rope, or, in other words, the movable pulley doubles the power, and can be increased in any ratio by adding to the number of pulleys. In a combination of pulleys, the advantage, however, is greatly diminished by the friction of the axles and of the ropes. Too complex a combination, therefore, would not be of service, as the friction would be increased without a proportional advantage, and from the complexity of the machine would be more liable to be put out of order." (*Vide* Blocks.)

**Pull-off**—In musketry, is the test applied to the trigger of all small-arms. The test is regulated so as to require a mean weight of about 7 lbs. to be applied to the finger-piece of the trigger, in order to release the sear nose from the top bent; this result is obtained only when the lock and trigger are perfectly clean and free from dried-up oil, or other matter causing obstruction to the free working of the various parts.

As a rule, the pull-off of the small-arms in use will be found to be influenced mainly by the condition of cleanliness of the lock and trigger.

Should the lock, after having been thoroughly cleaned and oiled, be found to pull-off either light or heavy, i.e. below 6 lbs. or above 8 lbs., it may easily be regulated by squaring the sear nose and top bent in the tumbler, care being taken to preserve the same angles.

**Pultun**—An Indian term for a regiment of infantry.

**Pump, Air,** *vide* Air Pump.

**Pump, Forcing** — As described in Weale's series, "is an engine for raising water above the level to which it is driven by the pressure of the atmosphere. The forcing pump consists of a barrel fitted with a solid piston or forcer, the barrel being also provided with a branch forcing pipe. The lower part of the barrel and the branch pipe are each fitted with a valve opening upwards, and by repeated strokes of the piston, the pressure of the air from above being removed, the fluid is brought up to fill the space between the two valves, and being prevented from returning by the lower valve, it passes through the upper valve of the branch pipe into a capacious upper vessel, and there accumulating, may be ejected in a constant instead of an intermittent stream."

**Punch**—A tool for cutting circular or other shaped pieces out of metal, wood, or other materials, and for forcing a hole through a plate.

**Punches, Steel Vent**—Used for clearing the vents of guns. They are of different lengths, according to the nature of the gun.

**Punching**—A term used in artillery. The penetration of a vessel's side, either by an elongated shot or shell, which is intended to kill the crew, blow up the magazine, damage the machinery, and sink the vessel by holes made through her at or near the water-line, is termed "punching."

**Punching Machine**—A machine for *punching* holes through thick metal plates.

**Punishments, Military** — Sentenc awarded by courts-martial or commanding officers for crimes committed b officers or soldiers. They are detailed i the Articles of War. They consist o death by hanging or shooting, accordin to the offence, and of flogging. These ar the punishments for the most aggravate and flagrant form of offences. Th minor punishments include imprisonment, loss of good-conduct stripes, de gradation of rank, loss of appointments extra drill, stoppage of pay, and confinement to barracks. An officer can b sentenced by a general court-martial t death, cashiering, or dismissal from th service, according to the crime he i guilty of. Without the intervention of court-martial, or any other form of dismissal, the services of an officer can b dispensed with by order of the sovereig

**Purchase**—The system formerly carrie out in the British army, whereby promotion was obtained amongst the seven ranks by the sale of an officer's commission. In 1871 a bill was passed b parliament for the abolition of purchas with the view of putting the regul army and the militia on the same footin and instituting a system of promotio throughout the service by seniority an selection. Promotion by purchase ha existed in all regiments—except in th artillery, engineers, and marines, for th last 170 years—death and other vacanci only being obtained without purchase.

In mechanics, the term *purchase* signifies to gain or have an advantag over something by mechanical mean in raising it; thus, to place a lever o handspike under any weight preparator to heaving it is a "purchase."

**Pursue, To**—To run after with desi to catch; to follow in hostility.

**Pursuit**—The act of running after an following with the desire of catching.

Pursuit comes after victory. Th great aim of pursuit is to prevent defeated enemy from rallying and reforming, and if it be well carried out his forces will soon be but a disorganised mass, without arms. This is done first, by the reserves being launche upon him so as to prevent his coverin his retreat by fresh troops, and then b following him up, pushing him withou

;, by means of horse artillery and
r passing round his flanks, and
ting to cut him off from his line
at, and thus increasing the con-
of the troops and abandonment of
l. (*Vide* Rear Guard.)

**ligneous Acid**—One of the pro-
of the destructive distillation of
which, in the manufacture of char-
retorts) is burnt in the charcoal
.

**meter** (Greek, *pur*, fire; *metron*,
e)—An instrument for estimating
at a high temperature, such
t at which the more infusible
melt, or of a reverberatory or
urnace for which the common
meter is unavailable. If an ap-
pyrometer could be obtained, it
be used with advantage for ascer-
the heat in all charcoal furnaces
powder purposes.

**techny** (Greek, *pur*, fire; *technē*,
—This term denotes the art and
of controlling and making use of
tible matter, particularly in the
cture of artificial fireworks.
origin of artificial fireworks ap-
o be unknown, but it has been
established that Eastern countries
India and China, which produce
e as a natural product of the
, made them long before they
troduced into Europe, which is
atively of recent date.
omposition which enters into the
cture of fireworks is the same
for gunpowder, viz. nitre, char-
nd sulphur, but generally in a
state; to which are added filings
ent metals, camphor, resin, lyco-
, &c., and certain chemical sub-
which give the various colours
d when they explode. For in-
iron and steel filings produce a
l white colour; copper, green;
ue; lycopodium, rose; &c.

## Q.

**Quadrant**—In gunnery, is an instrument, generally made of brass, for ascertaining or adjusting the elevation of ordnance, particularly mortars, which have no tangent scale. The quadrant is graduated into degrees and parts of a degree, having a movable index, with a spirit-level and vernier attached to it. When the instrument is used, the limb or bar of the quadrant is inserted into the bore of the piece; the index which is attached to the graduated arc is then fixed to the particular elevation required, and the piece elevated or depressed until the spirit-level is horizontal, which is shown by the air bubble running to the centre. Another pattern quadrant to that hitherto in use has been introduced into the service. It differs from the one generally known in being altogether of a stronger form; the bar or limb has been reduced to 12 inches in length; the base is broader, and is fitted with a stop to prevent its slipping into the chamber. The counterbalance weight is arranged so as to ensure the quadrant lying flat on the bottom of the bore of the piece.

A *gunner's quadrant* is an instrument employed, like the spirit-level quadrant, to give angles of elevation or depression when there are no sights to a gun, or when they cannot be used. It differs from the spirit-level quadrant in having no spirit-level, but a plumb-line which is suspended from the right angle.

**Quadrate, To**—To ascertain if a piece of ordnance is properly placed on its carriage, and the wheels are of equal height.

**Quaker**—A sham gun made of wood.

**Qualitative**—In chemistry, this term has reference to the properties of a body, and the kinds of matter of which it is composed, without reference to quantity.

**Quantitative**—In chemical analysis, is the determination or quantity of every individual element in the substance to be analysed.

**Quarrels**—An ancient name for arrows fired from the cross-bow, having a four-sided or pyramidal head. From this weapon there was also fired another kind of arrow called *vireton*, a French name. The arrows of this nature were fitted some with feathers, others without.

**Quarter**—"To give quarter" is to spare the life of a vanquished enemy. Under these circumstances it is usual to send a prisoner to his captors' quarter for liberation, ransom, or to be detained until peace be signed.

**Quarter, To**—To place troops under cover in any building; in fact, to house them, generally in barracks. When troops are thus settled for a season or any particular time, they are said to be quartered there.

**Quarter Guard**—A guard mounted in camp, immediately on the arrival of each corps on its ground. It is placed in front of the centre of the camp, at about 80 paces from it.

**Quartermaster**—An officer attached to each regiment of infantry and cavalry, also to a brigade of artillery and to the engineers, whose duty it is to look after the quarters and rations of the soldiers and the ammunition belonging to the regiment. On the march he has to attend to the billeting of the men and the laying out of the camp. A quartermaster holds the relative rank of lieutenant.

**Quartermaster-General**—An officer of high rank at the Horse Guards. He is the chief of the department to which he gives his title. He has under his control all matters relating to the marching, embarking, disembarking, quartering, billeting, cantoning of troops, encampments, and a variety of other duties, too numerous to be defined. The intelligence department also forms one of the branches of his office. All orders relating to his department are issued through him.

The rank of the quartermaster-general is ordinarily that of major-general. He is assisted in his office by a deputy quartermaster-general and an assistant quartermaster-general. To each district or division of the army, either at home or abroad, there is an assistant or deputy assistant quartermaster-general attached. Sometimes the duties of both the adjutant-general's and quartermaster-general's departments are performed by the same officer. The duties of the intelligence department are carried on under the supervision of the deputy quartermaster-general, all points of importance being referred to the quartermaster-general.

**Quartermaster-Sergeant**—A non-commissioned officer, an aid to the quartermaster. In a battery of artillery he performs the quartermaster's work. He ranks as a staff sergeant.

**Quarters**—In military stations, are the apartments in barracks or huts told off for the accommodation of officers and men. In India the quarters of officers are generally in houses or bungalows, which officers have to hire.

The rules regarding the choice of officers' quarters are detailed in the Queen's Regulations.

**Quarters, Head,** *vide* Head-quarters.

**Quarters, Out**—Small bodies of troops, when detached away from head-quarters of their regiment, are said to be at *out-quarters.*

**Quarter-sights,** *vide* Sights.

**Queen's Allowance**—An allowance in aid of the expenses of the officers' mess. It is applied towards reducing the cost of wine and diminishing the daily expenses of the mess, in equal proportions, viz. one-half for wine and one-half for mess expenses. This grant is also known as the *regent's allowance.*

**Queen's Colours,** *vide* Colours, Military.

**Queen's Regulations**—Regulations and orders issued by her Majesty (through the commander-in-chief), having for their object the regulation of the whole military system of the army, with reference to its internal economy and discipline. Every officer is directed to supply himself with a copy, and to make himself perfectly acquainted with the regulations.

**Quell, To**—To appease or put down a mutiny, rebellion, or any disturbance. When the military are called out to quell a disturbance, the Mutiny Act is read before any violence is proceeded with.

**Quick-match,** *vide* Match.

**Quick-time**—A pace soldiers ordinarily march at, viz. 3·3 miles an hour or 30 inches to the pace. (*Vide* Step.)

**Quilted Armour**—Armour formed of some padded material and stitched at r intervals. It was worn in the ages, and was known under the f *pourpoint.*

**ted Grape**—The old pattern grape which consisted of a round iron or bottom, having an iron pin in tre, around which the small shot iled, quilted with canvas, and tied, appear in form something like a of grapes.

**sey**—A throat complaint, which mon to horses; it is brought on d or chill. The symptoms are ty in swallowing, cough, fever. orse should be bled and given a all, and either a blister ointment rocation should be applied.

**ver**—The receptacle for holding ows of a bow, formerly worn by or bowmen.

**n**—A wedge of wood or iron laid the breech of heavy guns or the s of siege mortars, by which the is elevated or depressed. The natures of mortars, as well as l pieces, are fitted with elevating

**a**—That part which each member ciety has to contribute or receive king up or dividing a certain

## R.

**et, or Rebate**—A deep groove, nel, cut longitudinally in a piece er to receive the edge of a plank, nds of a number of planks, which e securely fastened in it.

**rs**—Circular rails of metal let ground on which the trucks of ng platforms run. The racers th wooden platforms are made of t iron, laid with the upper surface For wrought-iron traversing ns on which heavy M.L.R. guns size than the 10-inch gun stand, racers of wrought iron are used, but for guns of a larger size steel is substituted for wrought iron.

**Rack and Pinion**—A combination in machinery which is described in Baker's 'Elements of Mechanism' "as the connecting link between wheel work and the lever, and is the most simple machine of the kind for producing a continuous vertical motion with great power. In this machine the axis of motion forms the fulcrum of a lever whose longer arm is called the *winch*, and describes a complete circle; the shorter arm forming the 8 leaves or teeth of the *pinion;* and there is always one of these employed in lifting by one of its teeth the *rack* to which the load or other resistance is applied."

**Racking**—A term used in artillery. It is the impact of heavy projectiles moving at low velocities, and intended to shatter the ship's armour, and by repeated shakes, ultimately, to knock the whole structure to pieces.

**Racking-down** — An operation performed with the aid of *rack-lashing* in laying a gun or mortar platform, for the purpose of securing the planks and the ribands of the platform together, so as to prevent them from moving.

**Rack-lashing**—Rope used in pontoon or boat bridges for securing the baulks to the pontoon. Rack-lashing is also used for gun platforms, to secure the ribands, planks, and sleepers together. It consists of a piece of 2-inch rope about 6 feet long, fastened to a picket about 15 inches in length, having a hole in its head to receive the rope.

**Radiation of Heat**—In the description given on this subject, it is stated that "a body hotter than surrounding objects will give off its heat in right lines in all directions, and a body colder than surrounding objects will receive heat from them in right lines in all directions. The transference of heat in this manner is called *radiation.* Heat radiated from bodies follows the same laws of reflection as light. The rapidity with which bodies can radiate and absorb heat appears to depend mainly upon the nature of their surfaces. Bright metallic surfaces have least, and dark and rough surfaces the greatest, power, and may be said to be inversely semi-proportional to their reflecting powers."

**Radii of Rupture**—In military mining, to effect an explosion of the surrounding ground, a charge of gunpowder is used, which, according to its strength, the nature of ground, and the depth at which it is placed, more or less affects the quantity of earth to be displaced. Such an explosion raises and scatters a portion of the superincumbent earth, and causes a hollow or crater. Besides this effect, an internal commotion is caused, capable of injuring or destroying shafts or galleries in the immediate neighbourhood. The distances from the charge to which this commotion extends are called *radii of rupture*.

**Radius** — In geometry, the semi-diameter of a circle.

**Rafts**—Baulks of timber lashed together to form a bridge for crossing a river or stream, when more perfect means are not at hand. From their low degree of buoyancy, however, they are seldom employed.

Fir, pine, hazel, poplar, juniper, larch, and willow, being the lightest woods, are the best for making timber rafts. Rafts of timber should not be used in rivers where the velocity of the current exceeds 6 feet per second, or 4 miles per hour.

Good rafts can be made of casks or barrels, and form a better bridge than baulks of timber.

**Ragstone** — A slaty stone used for whetting or sharpening the edges of tools subsequent to their having been ground on revolving grindstones. The stone is imported from Norway, and gives a finer edge than sandstone.

**Raid**—Sudden incursion into a district by marauders or savage tribes.

**Rail**, *vide* Railways.

**Railways**, or **Railroads**—Roads constructed of iron bars called *rails*, on which the wheels of carriages roll, drawn by steam-engines, and to which they are confined by ledges or flanges raised on the tires of the wheels.

The history of the past twenty years shows the great value of railways in time of war. In mobilising armies, in concentrating them on the frontier or the threatened points of an invaded territory, and in bringing up material and supplies of all sorts from the base of operations, are found the principal advantages, in a military point of view, in the introduction of railroads previous to and during a campaign. Valuable use can be made of them even after the operations have begun, such as transferring fractions of an army from a distant point; bringing up reinforcements rapidly at critical times; and for other purposes which a general will employ as he thinks right.

It is in their effect in modifying the conditions of war, as far as supply is concerned, that railways are of great importance, as they enable an army to dispense, in a great measure, with the enormous transport trains which formerly passed between an army and its base; and from the great speed and comparative certainty that can be obtained from them, the area of supply is largely increased. The wounded and sick — which in former days remained in the place where they had fallen or in the neighbourhood, and thus encumbered the movements of armies —can nowadays be removed with greater ease and regularity, and receive better care in the hospitals established away from the field of operations. This also applies to prisoners of war, who can be promptly disposed of by means of railways. Great economy is thus obtained from the use of railways: economy of time and physical labour in the concentration of armies and accumulation of food and transport of stores; economy of life by disencumbering armies of the sick and wounded, who receive proper attention in established hospitals.

The introduction of railways in warfare has in no way altered the main principles which govern the selection of points on which magazines are established, and the direction of the lines of supply; indeed they have made the choice of these points and the establishment of magazines much easier, as they can be placed at the junction of important lines. However, as railways are more easily destroyed than roads, greater care than ever must be taken by generals to protect the lines of communication against the inroads of an enterprising enemy.

The influence of railways upon and their great value in military operations was exemplified during the Federal War i

America, and in the Franco-German war of 1870–71. General Sherman states that one single line of railroad, which he had conquered bit by bit from the enemy, supplied his army (100,000 men) so admirably that not a man, horse, or mule, was for a day without food, and the troops were always provided with abundant supplies of clothing and ammunition; and not only was the daily supply kept up, but provisions for several weeks were stored on different points of his line of communication. During the Franco-German war, the Germans, reaping the advantage of an offensive warfare, possessed numerous lines between their front and their base. During the investment of Paris, they were able, on a single line, to run from 12 to 14 trains a day, which enabled them to feed their army round the besieged town, to bring up artillery and siege material, and reinforcements averaging from 2000 to 3000 men daily.

Besides these enormous advantages, railways greatly facilitate the first operations of the assailants, and Colonel Hamley, in his 'Operations of War,' writes as follows on their influence in offensive and defensive warfare:—

"Offensive, compared with defensive, war must still be enormously costly. But the invader will retain and even augment, by means of his railways, the advantage of making a sudden concentrated advance on part of an extended line of defence; and even the combined resources of telegraphs and railways could not avail to meet the first onset under circumstances geographically unfavourable to the defence. . . .

"But, on the other hand, the defender, if forced to retreat, will easily destroy for the time the railways in the territory which he is quitting, while preserving the full use of those which he still covers; whereas the assailant must either content himself with the ordinary roads, or pause to repair the railways and to reorganise the means of supply through those channels. Thus the advantages of the initiative will, in such a case, be much more transient than before, and the defender will concentrate on the threatened line with far greater comparative facility."

From the above, the *same author* concludes that "an invader (supposing other circumstances to be favourable) should direct his attack on a part of the theatre where railways exercise small influence, since their effect, on the whole, is in favour of the defender.

"The movement to a flank, of large bodies, by rail, within reach of the enemy, must be especially dangerous, because the troops follow each other in small isolated fractions, and are very defenceless if attacked during the transit."

The Crimean was the first war in which a railway was prominently used. A line 5 miles in length was built from Balaclava to Sebastopol, and was worked by the land transport. This line was principally used for the transport of material, and, in a strategical point of view had no influence on the operations of the war. It was in the Italian campaign, when the French were able to pour troops into Piedmont with great rapidity and regularity, that the use and great advantage of railroads were shown for concentrating purposes; and on two occasions during that campaign, the armies in the field were augmented during the progress of the battle by fresh troops brought up by rail.

The civil war in America was the next conflict which illustrated the immense power and influence of railways; and during the war of 1870–71 railroads played a very important part, heavy calls being made on them; and by these means the Germans were able to place fifteen *corps d'armée*, complete, on the frontier in a fortnight from the day of the order of mobilisation being given. A Fell railway (*q. v.*) was also made by them and found very useful.

The experience obtained from these wars shows that, without a well organised railway department, war cannot at the present day be carried on with any prospect of success. The following on the means of managing railways on the continent may prove interesting to the reader, as a similar system, based upon them, has been lately introduced in this country, by an *Engineer and Railway Staff Volunteer Corps*. The object of this corps is to secure unity of action among the railway companies in time of war. It consists of three classes—namely, eminent civil engineers, the general managers of railway companies, and the leading contractors. Their duty is to consider points relating to the transport of troops, the formation of lines of railway, &c. and to meet any exigency in time of war, all which information would prove of great value.

In Germany the railways, as far as they are employed for military purposes, are under the control of the great general staff at Berlin, a special section of that department being entirely devoted to collect and arrange systematically all information on railways, at home and abroad, especially with regard to their capacity for carrying troops. This branch of the staff, works out the instructions given for the transport of troops and munitions of war, examines all projects of railways, and, lastly, prepares plans for the transport of German troops under different circumstances, so that in the event of war they can be concentrated with the greatest possible speed on any given point. The railway battalion, which was organised after the war of 1870-71, and which is now in full working order, is under the superintendence of this section.

This battalion is composed in time of peace of four companies, recruited from among the *employés* and officers of existing railways. The men are taught by very practical lessons how to construct and work a line, being employed, while learning the first duty, on the state railways and afterwards on a special line, called the "military railway," running from Berlin to the artillery practice ground at Zossen. On war breaking out, the battalion is mobilised, and consists then of eight *constructing* and four *working* companies. The duties of the former are to make impromptu lines, and for that purpose each company is provided with a train of its own, containing all the necessary implements. The four working companies, taking up the line as it is made, will begin to put it in running order, manning it with drivers, guards, stokers, pointsmen, and telegraph clerks from their own number, and, after the service is regularly established, handing it over to the ordinary civilian staff, while they pass forward to make a fresh section on ahead. This battalion includes three classes: line, reserve, and *Landwehr;* the two latter being at present supplemented by a list of ordinary railway servants, engaged for immediate enrolment in time of need.

In Russia, a system has been organised closely resembling that adopted by Germany. Every year picked men and officers are sent on all the railway lines, the former to study the theory of all that concerns the working and managing of railways, the latter to fulfil the duties of station-masters. In 1871, after two years' practice, these men (432 and 8 officers), together with a division of ininfantry, and a battalion of engineers, constructed in seven days a line of 5 miles in length, with two stations and ten bridges, one of them of 54 yards span. The cost of the line was valued at £21,200, and was so well constructed that it has remained in use ever since.

By an imperial ukase promulgated in 1870, all the Russian railway companies have to provide a certain number of carriages for the wounded, fitted up with litters, and well ventilated, and a number of carriages, wagons, and trucks, specially devised for military purposes.

France has also introduced a railway battalion under her new military organisation. The men of this battalion will be in time of war associated with the civil railway staff, and are classed in three categories: the first (two-thirds of annual contingent) is incorporated in the active battalion, and instructed as sappers and miners, or as soldiers of the engineer train. The second (one-sixth of the contingent) serves one year only in the active battalion; after which it is distributed among certain of the principal railway companies, in order to learn the working and management of the lines, their construction and restoration. The third (one-sixth of the contingent) serves only one year in the active battalion, and is then transferred to the depots. This carries on operations with torpedoes, and is practised generally in the destruction of railways, bridges, &c.

A very similar organisation of the military railway department has been established in Italy.

In most of the continental countries, the gauge of the existing railways is e same as in England, viz. 4 feet 8½ ches.

In reviewing the value of railways uring war, it must not be forgotten at their importance causes them to be ttacked, and consequently, when within ach of the efforts of an enemy, precau-ions must be taken for their protection. he nature of defence depends upon the ature of attack likely to take place. uring the American war, the railways ere exposed to constant raids from rge bodies of cavalry; isolated sentries, herefore, were of little use, and good ignalling observations and flying columns ere the modes resorted to for their de-ence. In the German war, under the *tappen* department, troops were supplied rom the *Landwehr* to carry out any mea-ures necessary for their protection, and hen there were not many regular troops vailable, the duty was committed to mall parties of patrols, and, if the rails were destroyed, the inhabitants were punished.

Next in importance to the defence of a railway, are the means of destroying it, and the reasons for doing so. The officer charged with this duty should be well acquainted with the time at his disposal, and with the nature of the operations of his general. It would not be desirable to destroy large bridges, or to create serious obstacles, when the object is only to delay the enemy for a short time, while troops are being assembled, after which the offensive is to be taken and the line reopened.

On the other hand, railways may be destroyed in a definite manner, so as to render them useless to the advance of the enemy, or to break up his lines of communication. This is done by removing the rolling stock, demolishing the water tanks, burning the stores of fuel, filling up the cuttings, making gaps in the embankments, blowing up the bridges and viaducts, and destroying or removing the permanent way.

In dismantling a railway, the points, crossings, and switches should be removed, and the rails destroyed. This is effectually done by heating and twisting them, it being impossible to use them when so treated. Concerning the destruction and repair of railways, little has been *added to the* above described modes during the war of 1870–71. Attempts were made by the French to stop the German convoy trains by means of torpedoes (*q. v.*), which were placed under the rails, and were to explode when the heavy trains passed over them. The danger was averted by the Germans forcing hostages to accompany the trains on the engine. This measure, which is scarcely according to the usages of war, proved efficacious, and the trains were left unmolested by the French, as soon as the fact was known that their own countrymen would forfeit their lives if any such attempt were made. (*Vide* Transport.)

**Rain Gauge,** *vide* Pluviometer.

**Raise a Siege, To**—To abandon the siege of a fortress or any other fortified town.

**Raking** — Enfilading or sweeping a work with artillery.

**Rally, To**—To re-form disordered or dispersed troops.

**Ram** — In hydraulics, a solid metal plunger or piston which fits tightly into the cylinder of an hydraulic press.

**Ram, Battering,** *vide* Battering Ram.

**Ram, To**—In fortification, means the act of compressing, by means of rammers, the loose earth used in building parapets and in filling gabions. Although a parapet of loose earth is less injured by shot than a rammed one, *ramming* is essential for the stability of the ramparts and parapets, as they might be seriously injured by a continuance of bad weather.

*To ram* is also a term used in thrusting home the charge into a piece of ordnance. Hence "to ram home" a charge.

**Rammer Head**—A circular block of wood attached to the sponge staff of light guns, and which is slightly hollowed out to receive a female screw for the purpose of withdrawing the charge, if necessary; to prevent injuring the fuze, the holes in rammer heads have been enlarged. The rammer head itself is used for ramming home the shot or shell into a gun or howitzer. The form and size of rammer heads depend on the nature of gun with which they are used.

Rammer heads for garrison and siege guns are not attached to the sponge staves, but there is one for each nature of gun, and the head is mounted on its own staff.

**Rammers** — Large blocks of wood, commonly used in military works, for the ramming of loose earth. The word *ràmmer* is also applied to the men employed in that duty.

**Ramp** (French, *rampe*, a slope)—A gentle incline of earth, constructed along the interior slope of a rampart, to facilitate the passage of artillery, &c. from the interior to the terreplein of the work, or in continuation of the roadway of a bridge. Ramps for artillery should not have slopes greater than one-seventh, and should be 8 feet wide for a field gun.

**Rampart**—In fortification, the great mass of earth thrown up from the ditch inwards, in order to give the defenders a commanding surface for their cannon and musketry. On the exterior of the rampart is the escarp wall, between 30 and 35 feet in height. It may either be detached from the rampart or may be joined to it, forming a retaining wall or revetment to its exterior. On the rampart stands the parapet. The term rampart is only applicable to permanent fortifications.

**Ramrod** — An instrument of iron or steel for ramming home the charge in muzzle-loading small-arms.

The first ramrods which were invented were made of wood, and were not attached to the musket, but were carried in the hand, or stuck in the belt. In this manner they got frequently broken, and often during an engagement only one or two sound ramrods were to be found in a company. The introduction of the iron or steel ramrod, which took place somewhere about 1741, rendered the musket therefore much more serviceable.

**Randing**—In fortification, is a kind of basket-work, formed in making gabions. One rod only is used, and an odd number of pickets, in forming the basket, the rod being passed alternately inside and outside the pickets. (*Vide* Brushwood.)

**Random**—Want of direction in firing a gun or musket; hence the expression, *to fire at random*. A *random shot* is a common expression when a fire-arm has been discharged without aiming in any particular direction.

**Range** — In gunnery, is defined as "the distance from the muzzle of a gun to the second intersection of the *trajectory* with the *line of sight*." (The first intersection is made near the muzzle, where the shot in its ascent crosses the line of sight.) "The *range* is not accurately the distance to the point at which the shot impinges on the plane, unless that is also the point aimed at, but the difference is practically of importance only at short distances. In practice the *range* is usually measured from the muzzle of the gun to the point of impact on the object, or to the first graze of the projectile. The range depends on the *initial velocity*, the form and density of the projectile, the *angle of elevation* of the gun, and the difference of level between the planes upon which the gun and object respectively stand."

The range of field artillery nowadays with rifled guns may be said to extend from 800 to 4000 yards; this, as suggested by a German general, may for convenience sake come under the name of the *zone of accurate fire*, and the *zone of imperfect fire*. The extreme range of rifled small-arms may be placed at 1000 or 1200 yards.

**Range Board**—This nature of board is intended for guns in fortresses, from the 7-inch calibre upwards; it is placed in a convenient position in the fortress where it can be seen and consulted. It has the distances painted on it of prominent objects within the range of the guns mounted on the works.

**Range, Maximum,** *vide* Maximum Range.

**Range of a Shot, Mean,** *vide* Mean Range of a Shot.

**Range Plates**—Plates of brass attached to the brackets of the 16-pr. and 9-pr. wrought-iron field carriages.

They are marked with three columns of figures, showing the range in yards from 100 to 4000 for 16-prs. and from 100 to 3500 for 9-prs., with the corresponding elevations and tenths of fuze.

**Range, Point-blank,** *vide* Point-blank.

**Range-finder** — An instrument for ascertaining the range of a piece of ordnance or small-arm. Nolan's is considered the best instrument of its kind for guns, and has lately been admitted into the service, after a considerable number of trials.

The following is a brief notice of the apparatus, as extracted from the *Times:* —"It consists of a pair of angle measures, right and left, each formed of a pair of telescopes, placed at right angles to and across each other, one telescope being much larger than the other. These instruments are mounted on tripods which fold up, and are carried just as level legs are, the instruments being packed away in leather cases for transport from point to point. In using the apparatus, the larger telescope of the instrument is directed at the object the range of which is required, the smaller one being directed toward the twin instrument upon the twin tripod. This gives the angle of which the intersection of the telescopes forms the apex, and the object and twin tripod the extremities. Besides the angle measures and their fittings, a 50-yard measuring tape and a metal calculating roller are required. The roller is a metal plate or disc, about 4 inches in diameter, inside which two flat rings are made to rotate, a number of figures and divisions being inscribed on each. To explain its use, it should be stated that the distance between the two tripods is first measured, and that an angle represented by a number never exceeding 100 is obtained at each of the two stations. There are, therefore, three numbers to be combined together or dealt with to obtain the range. To do this, one of the rings is turned round until the word 'tape' has been brought under the number given by the tape as the distance between the guns. The second ring is then turned until a mark representing a gun is brought under the number on the ring immediately above it, found by the angle measurer at one tripod. The third number, found at the other tripod, is then sought for on the inner ring of the roller. Above this is another figure, from which a line leads up to the actual range which is engraved on the outer ring. With this apparatus ranges can be readily found for guns before they are brought into position in front of an enemy." (*Vide* Telemeter.)

**Rank**—The relative position, in the army, which officers and men hold with respect to each other. The following represent the different ranks in the army: *regimental rank*, *local rank*, *army rank*, *relative rank*, *honorary rank*, *brevet rank*, *substantive* or *permanent rank.*.

*Army rank* is the position an officer holds in the army either by brevet or regimental rank. Should the date of commission of any two officers be identical, the seniority of position will be referred to the date of last promotion in the rank below.

*Brevet rank* is army rank, and superior to the regimental rank which an officer has attained. It is given for gallant service in the field, or for long service. In the latter case, for instance, a lieutenant-colonel becomes a brevet-colonel after having served 5 years regimentally in that rank.

*Honorary rank.*—Such increased rank as is accorded by her Majesty to officers who have retired on full pay from the service. A colonel under such circumstances is gazetted to the rank of major-general on retirement, but the rank confers no command or pay; it merely gives title and precedence.

*Local rank.*—The rank given to an officer in her Majesty's service serving in a foreign land with other troops, whereby he is placed in his proper position, as regards equality of rank, with those officers whose first commissions are of the same date, but who have been more fortunate in promotion. For instance, a British officer located in India, with his regiment and with troops belonging to the Indian army, may find himself junior in rank to an Indian officer, though his first commission is of the same date; to equalise their standing in the country, what is termed *local* rank is conferred by the commander-in-chief in India.

*Relative rank* is described as follows:—"Signifies the precedence which certain non-combatant officers and others are entitled to take among their combatant brethren; for instance, a commissary-general has the rank of major-general. Relative rank carries with it all precedence and advantages attaching to the military rank with which it corresponds, except command, and regulates rates of lodging money, number of servants, rations of fuel and light (or allowance in their stead), detention and prize money. Relative rank does not entitle the holder to salutes from ships or fortresses, nor to the turning out of a guard."

It has lately been determined that the assistant military secretary at the Horse Guards is to have the relative rank of colonel.

*Substantive rank* may be termed *solid* or *permanent rank*, such as confers upon an officer the pay of his rank with the position and precedence attending it. Thus a major drawing a major's pay, and consequently enjoying a major's position in his regiment, is an example of *substantive* rank.

The terms rank and appointment being very generally misapplied when used with respect to positions held by non-commissioned officers and men of the army, it has lately been notified by the commander-in-chief that the following are ranks, viz.:—Regimental corporal-major, regimental sergeant-major, quartermaster corporal-major, regimental quartermaster sergeant, sergeant, corporal, bombardier, second corporal, and private. All other positions, whether conveying relative rank or not, are appointments.

The term *rank* is also applied to a line of soldiers drawn up side by side in one row. This is called *single rank;* and *double rank* when there are two rows of men, one behind the other.

**Rank and File**—The body of soldiers constituting the mass of the army, and including all ranks from corporal downwards. Rank and file means also literally the lines of men from side to side, and from front to rear; a rank being a row of men standing side by side, and a file of soldiers a line of men standing one behind another.

**Ranking Past**—A military movement performed by mounted corps at reviews before the reviewing officer. It consists in marching past by single file or in sections.

**Ransack, To**—To pillage; to plunder.

**Ransom**—The price paid for the release of a prisoner of war from captivity or punishment, or the release of a private individual from brigands.

**Rapidity of Fire**—The rate at which ordnance of all natures can be fired. As remarked by Lieut.-Colonel Owen, in his 'Modern Artillery'—"When rapidity is combined with accuracy of fire, the effect is *greatly* increased, but the latter should not be sacrificed to the former, except at case-shot ranges; a too rapid fire is dangerous to the gunners, and wastes the ammunition. As a general rule, the fire may be more rapid as the range decreases, the probability of hitting being less as the range increases. In ordinary practice, rifled guns can be fired as quickly as smooth-bore guns, and muzzle-loading rifled guns as rapidly as breech-loading pieces. With well-drilled gunners, about two rounds of shell can be fired from a rifled piece in a minute,[*] the gun being properly laid at each round; three or four rounds of case can be fired in the same time."

**Rapier**—Formerly signified a long, straight broadsword, but is now understood to mean a light, edgeless, finely pointed sword about 3 feet long. This nature of sword is only now worn on occasions of court ceremonial.

**Rarefaction** (Latin, *rarefacio*, I make thin)—In physics, the act of causing a substance to become less dense; it also denominates the state of this lessened density.

**Rasp**—A species of file which is explained as being formed when the surface of the steel is dotted over with separate teeth formed by the indentation of a pointed chisel or punch. Rasps are used for woods and soft materials; double-cut files for metals and general purposes. They are in very general use with most artificers.

**Ratan** (*Calamus*)—The plants which yield ratans are considered by botanists as a genus of the family of palms. They are abundant in all the forests of the Malay and Philippine Archipelagoes, and are used extensively as cordage or ligatures, or in the manufacture of mats and basket-work. The best are the produce of Malacca. A coarse description is found in many parts of the peninsula of India, and it is used for ordinary purposes, as baskets, &c. It answers better than bamboo for baskets, and for strong fences when interwoven between stakes. The ratan, when burnt, yields an ordinary black for paint.

**Ratchet Wheel**—Is described as "a simple contrivance for preventing a wheel rning except in one direction. A lays into the teeth of the wheel, ing it to revolve, but preventing oil on the part of the weight, or ce contrary to the direction of er. This contrivance may be con- with other machinery by means . instead of cords, or the wheel e, as in the cases of the turn- bridges, &c., where the number s of the ratchet wheel is required gistered."

---

[*] Segment, with percussion fuzes, rather more quickly—about seven rounds in three minutes; but shrapnel, with time fuzes, only about five rounds in the same time.

**book**—A priced vocabulary of nent stores, by which officers and are debited for the loss of or in- ne to government property under arge, if committed through care- &c.

—In mathematics, the mutual of two *magnitudes* of the same one another, in respect of *quantity*. are divided into *arithmetical* and *cal*. An arithmetical ratio con- the difference of the quantities, ometrical ratio in their quotient. e arithmetical ratio between 6 and 4 or 2, which, added to the less, ne greater, or, deducted from the gives the less. The geometrical etween 4 and 2 is $\frac{4}{2}$ or 2, and the ng multiplied by 2 will make the or the greater divided by 2 will e less.

**n**—A soldier's daily allowance of d the daily forage (*q. v.*) issued to or other animal. In the Eng- ny the peace ration is ¾ lb. of lb. of bread per man; 37 lbs. of every 12 men daily; 2$\frac{3}{16}$ gills of very 18 men, and such groceries etables as the soldier chooses to he war ration is as follows:—

of bread.
of fresh meat, if procurable; if meat.
of rice.
of sugar.
of coffee, or in lieu of it ¼ oz. of

of salt.
of spirits.

ation varies slightly: 1 lb. of for 1¼ lb. of bread; tea instead ; fresh vegetables when avail- not to be *obtained, preserved* potatoes and compressed vegetables should be issued.

In a scientific investigation which took place some years ago, it was settled that the nutriments required to keep able-bodied men doing heavy work in health should contain three carboniferous elements to one nitrogenous.

In India the soldiers' ration consists of—

1 lb. of bread
1 lb. of meat.
4 oz. of rice.
2½ oz. of sugar.

$\frac{5}{7}$ oz. of tea, or coffee in lieu.
⅔ oz. of salt.
1 lb. of vegetables.
3 lbs. of firewood.

During the Franco-German war, the Germans largely used pea cake or sausage, which was introduced by Prince Frederick Charles. It was found to be very portable, and was marked in portions; it made good pea soup.

In the field, when provisions are scarce, an officer can claim to be rationed.

**Rat-line**—The rope or cord used for enclosing any spot or ground.

**Rat's-tail**—A tapering file; also the tapering at the end of a rope.

**Ravage, To**—To do all the mischief possible in a country by force of arms or other ways.

**Ravelin**—In fortification, a work having two faces forming a salient angle, placed beyond the main ditch opposite to the curtain, and separated from the covered way by a ditch that runs into the main ditch.

**Raw**—In a military sense, unripe in skill, wanting in knowledge. This term is applied to troops when they have little experience in the use of arms. Hence the expression, "raw recruit."

**Raze, To**—In fortification, to demolish, to level with the ground.

**Ready**—Prepared, prompt. It is also a word of command in rifle-firing exercise, being the contraction of *make ready* or be prepared.

**Reagents**—In chemistry, bodies employed by the analyst in ascertaining the presence of others under examination. They are usually divided into *general* and *special* reagents. The former designation is commonly applied to those substances which are used to separate bodies into different groups; and the latter, to those employed to distinguish the members of these groups from each other.

**Realgar,** *vide* Orpiment.

**Ream, To**—To scoop out; to enlarge or widen the bore of a piece of ordnance to the required calibre. The practice of *reaming out* guns, or *boring them up,* first took place in the British service in 1830; it was done with the view of increasing the weight of metal projected from such guns as were then on hand in the British service, at the time when the advantages of large-calibred ordnance were not absolutely decided on. It was therefore but a temporary expedient, and for that particular purpose, reaming out has been abandoned. But in the conversion of smooth-bore ordnance for the purpose of being rifled, the guns have still to be reamed out preparatory to being relined.

**Rear**—In the general acceptation of the word, anything situated or placed behind another. This term is variously used in military matters.

*Rear of a body of troops* means the hindermost part of that body, such as the *rear* of an army, battalion, squadron, or company; *rear rank,* the rank which covers the front rank.

**Rear Guard**—A detachment of troops which brings up and protects the rear of an army. It should be composed of companies from several regiments, not of whole battalions. The strength of rear guards varies from one-fourth to one-fifth the whole force, and should be formed from the reserves or the freshest troops. In an open country all the available cavalry should be employed, and always some of the best infantry, whether the army be advancing or retreating. In the former case, such a guard has for its object the collecting of stragglers, the protection of the baggage of the force or army, and the bringing-in in safety the last man who loiters behind, or the last cart or beast of burden employed in the transport of the stores or baggage. It is generally a tedious duty, and needs an officer of firmness and patience. In the latter, the duty is still more important, for in a retreating army, which in all probability is a beaten one, all is in confusion. Men are unwilling to form, especially if run in upon by the pursuing army, and consequently great disorder may be expected if arrangements are not made by the retreating general to check the pursuit of the enemy. To meet such a possibility and danger, generals, as Colonel Hamley states, usually keep part of their reserves out of action, in order to cover the retreat, which will give time to restore order, and to take advantage of favourable ground to make a stand; under such circumstances, seldom more than a fifth or sixth of the total force forms the rear guard, especially if it be formed entirely of the troops of the reserve.

**Rebate Plane**—In carpentry, a surfacing plane, having the cutting edge of the iron extending the full width of the sole of the plane.

**Receiver** — In chemistry, a form of vessel employed to collect the product of any distillation. Receivers used in the laboratory, generally, consist of glass globes of sizes, provided with one or more necks.

**Reciprocal** (Latin, *reciprocus,* alternating)—In mathematics, is that number which, when used as a multiplier to the number, gives 1 as the result. For instance, the reciprocal of 7 is $\frac{1}{7}$ or ·1428571, and *vice versâ.*

**Reciprocal Defence**—A sort of flanking defence, to be found in permanent fortifications. In constructing works of this nature, the following are the objects aimed at:—

"1. To afford cover or protection to the guns, masonry, and bodies of the defenders from the effects of an enemy's fire of every description.

"2. To arrange the covering works in such a manner that the defenders may use their weapons with facility, and that the enemy may be kept under fire from his first appearance within range of the heaviest guns to the moment even of his arrival at the crest of the defender's works, a condition which necessarily leads to the introduction of reciprocal or flanking defence, as it would, in many cases, be impossible that it could be fulfilled by means of direct fire alone, each work of defence becoming a cover to the assailants against the fire of its defenders when they have advanced to its base, it being also evident that flanking fire is much more efficient than direct fire.

"The term 'reciprocal' here used expresses more fully the character and ject of such defence than the term lanking,' as it generalises the idea ended to be conveyed, by including verse fire and every arrangement by nich the ground not acted upon by rect fire of one part of a work is ought within the action of the fire of nother part."

**Reciprocating Motion**—The movement a body backwards and forwards. Reprocating motion is frequently required some kinds of machinery, and the pplication of this motion is best observed y a crown-wheel, double rack, and ccentric wheel.

**Reckonings**, *vide* Off-reckonings.

**Recoil** (French, *reculer*, to go back)—In artillery, the motion of a gun and its carriage, or of a small-arm, in a direction opposite to that of the shot when the piece is fired. It is caused from the ignition of the charge impelling the gun and shot in opposite directions. This action of recoil has a very destructive effect upon the carriage of a gun. With heavy guns, the effect is considerably reduced by the use of hydraulic or pneumatic buffers (*q. v.*).

Recoil, it is stated, has no effect upon either the velocity or the range of a projectile in artillery guns. The shot, it is believed, has left the piece before the gun commences to recoil. With small-arms, the recoil is known as the *kick*, and there is a perceptible difference in the range whether the gun be fired from the shoulder or from a fixed rest. The 'Artillerist's Handbook of Reference' gives the formula for ascertaining the velocity of recoil of a gun and its carriage.

**Reconnaissance** — The act of reconnoitring; an examination of a portion of country with a view to ascertaining its resources for the movements and subsistence of an army.

This duty properly belongs to the quartermaster-general's department, but as light cavalry is, nowadays, constantly employed in gaining intelligence of the enemy and reporting as to the features of the country in front of advancing armies, cavalry officers, and, indeed, all officers, should be able to make intelligent reports on and sketches of roads, rivers, and military positions. With *this view*, classes of instruction in reconnaissance have been formed in the principal military stations under the quartermaster-general's department, in connection with the intelligence department of the army.

Reconnaissances are of two kinds: 1. Reconnoitring the enemy, or *offensive* reconnaissance; and 2. *Topographical* or *defensive* reconnaissance of ground.

An enemy may be reconnoitred either secretly or openly by force. In the first case, the reconnaissance is executed by an officer alone, or accompanied by a small escort; he endeavours to approach the enemy's position as near as he can to ascertain his strength and intentions, and even, if necessary, to draw upon himself the fire of his sentries, which would disclose the position of his outposts.

In the second case, the reconnaissance is undertaken for the purpose of discovering the strength and position of an enemy, with the view of attacking him. The execution of such a reconnaissance demands great intelligence, and as it cannot be thoroughly practised in time of peace, and can only be practically learnt in actual service in the field, no rule can be laid down as to the mode of carrying it out. This kind of reconnaissance is conducted by a general officer, who, at the head of a considerable force, marches openly towards the enemy, drives in his outposts, and forces him to discover his position and line of battle. Such a reconnaissance is called *armed reconnaissance* or *reconnaissance in force*. It should be resorted to as seldom as possible, as it often leads to collisions, sometimes even to general actions.

A *topographical reconnaissance* of ground is undertaken by staff officers or others for the purpose of obtaining information for the general in command relative to the country in which he is operating. No operation in war can be safely conducted unless the officer commanding the troops in the field is acquainted (either personally or by means of information supplied by others) with the country in which he is acting. As it is impossible for that officer to examine the country minutely by himself, he employs others to do so for him, and to obtain such information as is necessary for the proper combination of his movements, in conjunction with the information previously obtained from the intelligence department (*q. v.*). The importance of reconnaissances can hardly be over-estimated, for upon their accuracy the fate of a battle or even of a campaign may depend. This instruction should therefore not only be confided to military colleges and the staff, but also practised by officers of every branch of the service, so as to enable them to perform in an efficient manner the duties of flanking parties, of detachments, and of outposts.

A topographical reconnaissance consists of a sketch of the ground, accompanied by a written report. Want of time, and the presence of the enemy, may prevent an officer from doing more than making a rapid examination of the country or object he is ordered to reconnoitre. In this case a written report without a sketch may prove of great value.

Certain qualifications are necessary to be possessed by officers sent on reconnoitring duties, such as a facility in sketching, in judging distances correctly by the eye, by their own pace, and that of their horses. A knowledge of the language of the country reconnoitred, of fortifications, as well as the habit of observing ground with reference to military operations, are most useful.

In reconnoitring, the following general observations and notes should be made :—

*Roads.*—These should be examined and described mile by mile, and a report made upon them as to their width, their fitness for cavalry, infantry, and artillery; whether they are likely to become impassable in bad weather; whether easily repairable, and whether materials for mending them exist near at hand and of what kind; their contraction, such as fords, bridges, and defiles; width, material, and strength of the bridges; the means of defending the passage over them. The names of the towns, villages, and single houses along the road; the cross- and by-roads, and the distance to the towns, villages, and private houses they lead to.

*Rivers and streams.*—Their sources and their general direction ; their breadth, depth, nature of their bottoms, banks, and beds; whether navigable, and by what description of vessels ; the quality of their water, and the variations to which they are subject at certain seasons; the number of fords, their quality; capacity, and possibility of impro ment; the nature of the ground wit cannon-shot of each bank. The bridg the material used in their constructi their length and breadth ; whether ac sible to artillery and capable of sust ing its weight; the best method destroying, and what material at hand repair them if destroyed ; the best p tion for defending them and work defend them. The ferries; their leng nature, and landing place on each the number and nature of boats the number of men and horses that can transported at each trip.

*Canals.*—Their course and breadth ; t nature of the traffic carried on by th the number of boats and their capacit the number of locks, and how they be destroyed or repaired.

*Fords.*—When and where passa nature of their bottoms, whether clay, rock, or gravel ; notice landma depths, fluctuations. Describe the r and approaches to the fords ; best posit for defending them, and what works to constructed to cover them ; how they be improved, and how to be obstructed

*Marshes, lakes, and ponds.* — Th situation and extent, boundaries, navi tion, landing-places. The method means of crossing them ; how fed water; if dry at certain seasons; th general character.

*Inundations.*—Their cause, and me of traversing them; or if impass what are the shortest routes ro them.

*Mountains and hills.*—What parts the country are mountainous, hilly, undulating; whether the hills are or broken by rocks, or if their ascent gradual. Their roads, passes, and pat whether practicable to artillery, caval or infantry. The best way of defend them; the works that will be requi to improve them; the supplies to obtained. The nature of the valleys ravines; their breadth, and whether or difficult of passage.

*Defiles.*—Note their length and t nature; how they can be occupied defended in case of retreat. Whether can be attacked or turned if stro occupied.

*Forests and woods.*—What roads pass through them; their extent and their capacity for troops; whether they are an advantage or hindrance to attack or defence. The kind of trees composing them; whether adapted for abatis, entanglement, or for telegraphic purposes; if far apart, permitting cavalry to penetrate, or thick and difficult to traverse. Single trees should be noted, or other conspicuous objects to give direction to columns.

*Towns and villages.* — Their size; whether fortified or open, the number of houses and inhabitants; what supplies can be obtained. The description of houses and the number of troops which can be accommodated; what stabling or other cover for horses; the best means to place them in a state of defence if attacked; whether healthy or unhealthy at particular seasons and the cause; the supply of water; the number of carriages, horses, mules, and draught oxen; of bakeries, butchers' shops, mills, and forges.

*Detached houses.*—How they are built; of what materials their roofs; if well supplied with forage and provisions; their defensible capacities; whether easily burnt.

*Railways.*—Their direction, length, and gauge; their construction as regards the country through which they pass; tunnels, cuts, and viaducts; their breadth and length and depth. Whether they consist of double or single lines; description of rails used, and how secured. The number, size, and situation of stations; the means they afford in transporting troops and material; the quantity of rolling stock they possess (locomotives, carriages, trucks, &c.), their adaptation to transport, and the best means of destroying them.

*Positions* should be reconnoitred with a view to their military occupation, and, in doing so, the number and description of troops necessary to occupy them, as well as their distribution, according to the features presented by the positions, should be taken into account. No rigid rules can be laid down upon this point; but the depth of the position, the obstacles, such as rivers, morasses, &c., whether in rear, front, or *flanks, the* means of strengthening them, the key or keys, and lines of communication should be considered.

These principles apply equally to the selection of sites for encamping grounds; the supply of water and means of transport should be noted; the space required, the best position for head-quarters and outposts, as well as its sanitary condition.

In reconnoitring a fortified post or village, all obstacles that may impede the march of the attacking force should be observed and reported upon.

*Fences.* — Their use as defences, and how they may be levelled.

*Slopes.*—Whether all arms can move up and down them; whether cavalry, after ascending, will be in a condition to charge.

*Districts.*—It should be observed what parts are mountainous, hilly, or flat; nature of hills, direction of chief ridges, extent of their valleys and ravines; whether the country is barren or cultivated; by what cattle and in what numbers it is grazed; what parts are open, and what parts are enclosed; the nature of enclosures and of the soil; what parts are suitable for cavalry, infantry, and artillery; care should also be taken to observe the geology, botany, and climate.

The general features of the district should be considered with reference to their bearing upon any plan of campaign which may be denoted in the instructions as being under consideration. The best positions to be occupied with a view to the operations of the campaign should be pointed out and described, and a sketch of them should be annexed to the report. The lines of operation, either covered or impeded by them, as well as any positions favourable to the enemy, should be noticed.

Reconnaissances can be made daily from outposts by officers commanding pickets. These, with a few men, can creep up to commanding points near the enemy's position for the purpose of seeing what he is about.

An easy mode of finding out whether a village is occupied by the enemy or not is by sending a party of horsemen at full gallop through the main street.

If occupied, the enemy will fire, and, if not, the party will pass unmolested, and thus the information be obtained.

Balloons (*q. v.*) afford effective means of learning the whereabouts and doings of an enemy.

Before disembarking troops on the enemy's shore, in order to select a good spot for that purpose, a reconnaissance should be made by the naval and military officers. (*Vide* Disembarkation.)

**Reconnoitre, To** (French, *reconnaître*, to view, to examine) — In military phraseology, this term means to observe the country and the enemy; to remark the roads, obstacles, &c. by means of reconnaissances (*q. v.*).

**Recruit, To** (French, *recruter*) — To supply what is wanting. In military life, to fill up the ranks of a regiment with young soldiers who have enlisted to serve in the army.

**Recruiting Districts**—Districts formed in several parts of the United Kingdom under the charge of officers specially appointed for that purpose, aided by non-commissioned officers, to recruit men for the several regiments and departments of the army.

**Recruits**—Men raised for service in the regular army and militia, to fill vacancies in regiments or to augment the strength of the army. A recruit remains a recruit from the date of his enlistment until he has passed his drill, which extends generally to 16 weeks.

The Mutiny Act details the rules and regulations to be observed in the enlistment of recruits. (*Vide* Enlist, To, and Smart Money.)

**Rectification**—In chemistry, the process of drawing anything off by distillation, in order to obtain it in a state of greater purity.

**Rectilinear**—Consisting of right lines.

**Redan**—In fortification, the simplest kind of trace for fieldworks, having two faces, forming a salient angle; it serves to cover a bridge, causeway, avenue, &c., and being quite open at the gorge, is only suitable for defence when resting its extremities on a river or obstacle which prevents its being turned, or else, when within the full sweeping fire of works in its rear, that an enemy may be deterred from any attempt to assault by the gorge.

**Redoubt**—In fortification, a fieldwork enclosed on all sides, having its ditch not flanked from the parapet. It may be of a *square*, *polygonal*, *circular*, or *irregular* figure; the circular form is rarely used, from the unsuitable nature of such an outline to ground in general, and the total impossibility of giving any flanking defence to its ditch. The sides of a square redoubt should not be less than 24 yards, or in general more than 48 yards.

**Red-sear Iron**—A defect in iron which causes it to become brittle when heated, and to break when forged.

**Red-short Iron**—One of the three principal varieties of malleable iron, possessing this defect, that it is brittle when hot; but extremely soft and ductile whilst cold.

**Reduce, To**—Means to constrain, to force. *To reduce a place* is to oblige the garrison to surrender it to the besiegers; to capitulate. *To be reduced to the ranks* is to be reduced from a superior rank in a regiment to that of a private.

**Reduit**—In fortification, a keep capable of defence after the enemy has penetrated into the outer works of a field fortification or military post; it greatly tends to the security of any work. It should have a command of 5 feet, so that it may not be seen into by the enemy. Blockhouses form the most suitable reduits for fieldworks.

**Reef-knot**—A knot in common use for lashings when two ropes, or the ends of one rope, have to be fastened so as to be easily undone.

**Re-engagement** — The permission granted to soldiers, before and after being discharged (within a stated period), on completion of their first period of service, to re-enter the army. The conditions under which they can re-engage for a further period of service are given in the Mutiny Act.

The substance of the act is as follows. By the 55th article of the Mutiny Act, any soldier who has commenced the last year of his first term of enlistment, or who, being within 3 years of its expiration, is ordered abroad, may, with the approval of his commanding officer or other competent military authority, be re-engaged for such period as shall complete 21 years; and at the end of that term he may continue to serve with the approval of competent authority. Soldiers who have taken their discharge at the expiration of limited engagement may be permitted to re-engage, provided they do so within 12 months from date of discharge, are of good character, and under 34 years of age. Soldiers who have declined to re-engage abroad, and have been sent home at the public expense, will not be permitted to re-engage in this country.

**Re-entering Angle**—In fortification, is an angle pointing inwards or towards the place.

**Re-entering Order of Battle**—An order of battle, the front of the army forming a re-entering or enclosing angle, and the reverse of the salient formation. This order presents many advantages, as it can enclose the enemy, and shake morally and physically the troops which form the angle of the salient, by their rear being threatened and their retreat cut off.

**Re-entering Places of Arms**—Enlargements in the covered way, at the re-entering angles of the counterscarp; this space is formed by setting off demi-gorges of 30 yards (more or less), and making the spaces form angles of 100° with the adjoining branches of the covered way.

**Reeve, To**—To pass a rope or tackle through a block.

**Refining**—The purification of any metal or salt; such as nitre, for instance, undergoes before it is fit for gunpowder purposes. For the process observed, *vide* Saltpetre.

**Re-form, To**—In drill, means to bring back, after some manœuvre, a body of men to its natural or original formation by aligning it on some given point.

**Refraction of Saltpetre**—In commerce, is the ascertaining, with accuracy, the quantity of pure salt, or the amount of impurities, contained in a given sample. Government, for gunpowder purposes, generally purchases saltpetre at 5 per cent. refraction.

**Refuse, To**—A military phrase, signifying to throw back, or to keep back out of the regular alignment which is formed when troops are upon the point of engaging the enemy. Thus it is said, in the oblique order of battle, that if the right flank attacks, the left must be "refused."

**Regent's Allowance**, *vide* Queen's Allowance.

**Regiment**—The derivation of the word "regiment" seems to come from the Latin *regere*, to rule or govern. Hence a regiment is said to be governed or commanded by a colonel. A regiment consists of a body of soldiers enrolled together, consisting of one or more battalions of infantry, or several squadrons of cavalry. In the British army, most of the regiments have only one battalion (*q. v.*). The regiment of artillery is composed of brigades, the term brigade being synonymous with that of regiment, and each brigade is commanded by the senior lieutenant-colonel. The engineers are termed a corps, not a regiment, and the organisation of that body is in companies; the system of brigades, as in the artillery, or of battalions, as in the line, not being observed. The word regiment began to be applied to bodies of British troops in Elizabeth's reign; regiments are spoken of at the time of the Armada, 1588, and as composing the force in Ireland, 1598. From that time forward, the army and militia of Britain have been organised into regiments.

**Regimental**—Anything belonging to a regiment.

**Regimental Band**, *vide* Band.

**Regimental Colours**, *vide* Colours, Military.

**Regimental Orders**, *vide* Orders, Regimental.

**Regimental Parade**, *vide* Parade.

**Regimental Schools**, *vide* Schools, Military.

**Regimental Staff**, *vide* Staff.

**Regimental Transport**, *vide* Transport.

**Regimentals**—The uniform clothing of officers and men in the service, as laid down for each regiment and department. (*Vide* Clothing, Military.)

**Regiments, Linked**, *vide* Linked Regiments.

**Regular**—According to rules; made in form; such as *regular attacks*, that is, attacks made by regular approaches.

*Regular*, when applied to the army, signifies well disciplined and fit for service; hence *regular* troops.

**Regulars**—Troops whose conditions of enrolment are not limited to time or place, in contradistinction to militia and volunteer corps.

**Regulation Price**—As applied to an officer's commission, was the regulated price paid by officers for each step of rank (according to a fixed scale), other than death vacancies, vacancies caused by augmenting a regiment, or vacancies resulting from the promotion of colonels to be major-generals. When an officer of any rank, from a lieutenant-colonel downwards, was desirous of retiring from the service, he was entitled to sell his commission for the price stipulated by the regulations. Sometimes he received more than the regulation sum.

Purchase being no longer permitted in the army, the sale of commissions mentioned in the foregoing paragraph has only reference to officers who entered the army before November 1, 1871.

**Regulations, Military**—All codes of rules which have been embodied for the guidance of officers of the army, to insure uniformity in carrying out the permanent orders of the government or commander-in-chief; such are the *Articles of War*, *Mutiny Act*, and *Queen's Regulations.* All warrants and orders of the Secretary of War issued from time to time for the guidance and instruction of the civil and military branches of the army may also be classed under the head of military regulations; they are communicated to regiments and departments in monthly army circulars through the Horse Guards.

**Regulations, Queen's,** *vide* Queen's Regulations.

**Regulator**—As described by Lardner, "a class of contrivance which has for its object to render the power and resistance proportionate to each other. Regulators generally act upon that point of the machine which commands the supply of the power by means of some mechanical contrivances, which check the quantity of the moving principle conveyed to the machine whenever the motion becomes accelerated, and increase the supply whenever it becomes retarded. For example, this is accomplished in a steam-engine by acting on a valve called the throttle *valve, placed* in the main pipe, through which steam flows from the boiler to the cylinder."

**Reinforce**—The name given to that part of a gun where an increase of metal is required to enable it to withstand the explosion of the charge. There are two reinforces in the ordinary smooth-bore cannon; the *first reinforce* extending from the rear of the base ring to that of the first reinforce ring, a little in rear of the trunnions; *second reinforce*, from the rear of the first to that of the second ring in front of the trunnions. It is in the first reinforce (round the breech) where the greatest thickness of metal is found. Since the introduction of coiled guns, the term reinforce is in disuse in describing rifled ordnance.

**Reinforce, To**—To strengthen; to fortify.

**Rejoinder**—In military courts-martial other than *general* courts-martial, is the defendant's answer to the plaintiff's replication; that is, when the prosecutor makes a reply to the defendant, the latter may answer again, and he may even call witnesses to re-establish the character for credulity of such of his witnesses as may have been impugned by the prosecutor's evidence in reply.

**Release**—As applied to soldiers undergoing imprisonment, is the prerogative of a commanding officer to release a prisoner from confinement. This power is vested in him alone. He has further the power of remitting the sentence of a regimental court-martial, convened by himself, and directing the release of the prisoner, should he not approve of the sentence or finding.

**Relief**—In fortification, the general height to which the works are raised: if the works be generally high and commanding, they are said to have a *bold relief*; if the reverse, a *low relief*.

The term *relief* is also given to a party of soldiers detached from a guard, who relieve sentries off their post on the expiration of their term on duty.

**Relieve, To**—To replace; to change. In military language, this word applies to bodies of troops when they take the place of others. Thus *to relieve guard* is to change or put fresh men upon guard, which is generally done every 24 hours.

*To relieve the trenches* is to change the guard of the trenches.

*To relieve sentries* is to put fresh men on sentry duty. This is done ordinarily every 2 hours, by the corporal of the guard, who sees whether the relieved sentry gives over the instructions he received to the one relieving him.

**Remblai**—In fortification, the quantity of earth or soil contained in the mass of the rampart and parapet of a work. In general, the number of cubic feet contained in the *remblai* has been furnished by the *deblai*, so as to balance each other.

**Remission**—Abatement; forgiveness. Remission of punishment, as regards a soldier tried by a court-martial, is in the power of the confirming authority, and he can at any time remit any portion of the sentence at discretion. The periodical visitors of military prisons have the power of recommending remission of punishment. When a prisoner confined in a military prison is recommended for a remission of punishment by his commanding officer, the recommendation should be submitted for the approval of the periodical visitors.

Though a soldier's punishment may have been wholly remitted, there is to be no remission of any penalty consequent on his conviction, such as forfeiture of service, good-conduct pay, &c. (*Vide* Queen's Regulations.)

**Remonstrate, To**—To urge strong reasons against the instructions given by superior authority. If an officer or soldier considers himself aggrieved on any point, he is permitted to represent his case, but it must be done in a respectful manner through his commanding officer to higher authority; at the same time, where the duty of the service may require it, that duty must be first carried out with cheerfulness and alacrity.

**Remount, To**—To furnish the cavalry with horses in the room of those which have been killed, disabled, or cast.

**Remounts**—The name given to horses that are passed into the government service by purchase for artillery or cavalry purposes, or which are reared in a stud (*q.v.*), as in India. The general age of remounts varies from 3 to 5 years old.

**Rendezvous** (French)—A term expressing any appointed place of assembly or meeting.

**Report**—A specific statement on any particular subject, or person, which superior authority may desire to possess, and which it is in the power of the person applied-to to afford.

The word *report* is also used to express a loud noise, such as that made by the discharge of a cannon or musket. The distance to which cannon can be heard depends on the wind and the state of the atmosphere, also whether conveyed over water, which considerably increases the distance to which sound can reach. During the Sutlej campaign in 1845–46, the report of the guns at the battle of Sobraon was distinctly heard at Loodianah, a distance of 80 miles. But the report of cannon, it is stated, has been heard at far greater distances. (*Vide* Sound.)

**Report, To**—To make a statement of facts when an officer or soldier is accused of a breach of military discipline. A report is usually made by stating on paper in official form, by the officer making the report, the nature of the case, for the information of the commanding officer. In a regiment this is done through the adjutant.

**Reports, Confidential,** *vide* Confidential Reports.

**Repository**—A museum, or place of deposit of musters or samples of the different arms, tools, stores, &c. used in the service. The repository at Woolwich forms a school of instruction for both officers and men on first joining the artillery, and is interesting and instructive to all ranks in the regiment.

**Repository Exercise,** *vide* Exercise, Repository.

**Reprimand**—A rebuke, which is included in the army under the head of punishments. Courts-martial only inflict it on officers, in which case it may be either a simple reprimand or a severe reprimand, and may, at the discretion of the confirming officer, be administered privately or publicly.

**Reprisal**—Retaliation; a species of vengeance. Reprisals form the worst features of warfare, and are seldom resorted to in conflicts between civilised nations, or, at least, should not be. They are carried out by submitting prisoners or men found with arms in their hands to the same as or even worse treatment than is imposed upon the prisoners of the other side.

The word *reprisal* has reference also to the capture of property belonging to the subjects of a foreign power, as well as to the capture of the subjects themselves, in satisfaction of losses sustained by a citizen of the capturing state. Letters of reprisal are grantable by the law of nations where the subjects of one state have been oppressed or injured by the subjects of another, and where justice has been refused on application by letters of request.

**Request, Courts of**—Local courts assembled periodically in India, for the recovery of small debts not exceeding 400 rupees. In each military cantonment, a court of request is assembled monthly, and all persons are amenable to it except soldiers in the ranks. Not less than three officers, all military men, should form the court.

**Requisition**—A most common and usual system pursued by armies to secure food during war. The term includes all compulsory systems, whether by seizure, billeting, or demand, and whether supplies, so obtained, are paid for or not.

Though the term is comparatively modern, the principle is old, seeing that armies were at times largely fed by seizing the produce of the country they occupied. In former times the country was plundered in the most reckless and wasteful manner, but supplies are now collected and stored in magazines (*q. v.*) in rear of an army, and a requisition is made on them for the daily wants of the troops. Of all the systems of supply, the roughest and readiest is seizure, but it should be avoided if possible, as it only brings on the worst features of a campaign, viz. collision with the inhabitants of the country, plunder, waste, and sundry other acts.

**Reserve**—In a general sense, a reserve is a body of troops organised and brought together to supply and fill up the vacancies of an army in the field.

Reserves are of two kinds: *strategical* and *tactical*. *Strategical* reserves are forces whose members in peace time pursue their usual occupation, but are called out in time of war either to garrison towns and strong places, or, if necessary, to take an active part in the field. Nearly all the continental armies have their reserves, reserves of the active army and reserves of the territorial forces; they are men who have served a number of years in the ranks. (*Vide* Foreign Armies.) This system has been universally adopted, as it would be too costly, and the country would suffer from want of hands, if it maintained under arms the number of men called upon to serve by compulsory service.

In the British army this force consists of the auxiliary forces (militia, yeomanry, and volunteers), as well as the army reserves (*q. v.*), the militia reserve, or any other reserve and land forces, as defined by act of parliament, within the United Kingdom, serving or liable to be called upon to serve her Majesty in any military capacity, and not forming part of the active army. In case of war or of an invasion of the country, these troops would be mobilised with the regular army. (*Vide* Mobilisation.)

During the period the reserve forces are assembled for training or exercise, they are under the command of the officer commanding-in-chief, and of the general officers of the regular forces commanding in the districts within which such militia regiments or corps are assembled. All orders are conveyed to these forces from the commander-in-chief through the inspector-general of auxiliary forces, who is attached to the head-quarter's staff of the army for that purpose.

As nations have their reserve armies, so have armies their division reserves; these are *tactical* reserves. They are bodies of troops retained in the rear of an army, generally, to support an attacking force, or to protect its retreat in case of defeat.

"There is no principle in war more universally recognised," writes Colonel Graham, in his 'Art of War,' than "the importance of a reserve on the field of battle. It is the instrument in the hands of the general which he holds to conquer events and restore the fortune of the day. The wisdom of keeping a body of fresh troops in hand to the close of an action is apparent; the safety of the army depends on it."

History proves that battles have been cided by reserves, and that victory is mmonly the prize of the general who the last to bring his reserves into action. was to the proper employment of re-rves that Napoleon owed so much of his ccess; and the barren victory of Borodino d his complete defeat at Waterloo are y many attributed, in the one case to is holding back the guard altogether, d in the other to his delay in using it. mini and other writers lay down that serves being the last argument on the ttle field should always be composed f troops of a superior kind, but the xperience of recent wars shows that, on count of the new tactics which have been dopted since the introduction of arms of precision, all troops, so far as they have not come into action, are reserves to the leader.

Reserves should be placed near enough to support the troops in action, but they must be kept out of sight, and their position concealed from the enemy. Their distance from the second line depends entirely upon the nature of the ground, as well as upon the extent of the ground covered by the line from right to left; and their strength should consist of about one-fourth or one-fifth of the whole force in cavalry and infantry, and of about one-third of the guns. The reserve batteries may either be kept with the main reserve, or concentrated on any point where their united fire may help to shake the enemy previous to the final attack.

In the attack of a fortress, no assault should be attempted without a sufficient reserve, which should be well placed for following the supports of the escalading parties; its strength should never be less than three-fourths of the garrison of the work assaulted.

**Reserve Ammunition**—This term is applied to the supply of war ammunition carried in rear of an army for replenishing men and guns with fresh ammunition in case the first supply fails.

The *reserve ammunition* of a regiment s carried in carts, one for the cavalry and hree for the infantry. These carts can arry 9600 rounds each of Martini-Henry r 8960 rounds of Snider. In the artillery, here are three reserves of ammunition. he first (108 rounds per 9-pr. and 2 per 16-pr. gun) is that *contained* in the second line of wagons of each battery; the second (44 per 9-pr. and 108 per 16-pr. gun) is conveyed in the artillery general service wagons, and should be always up with the army, but kept from under fire. The third reserve is carried by the transport, and contains 200 rounds per 9-pr. gun and 200 per 16-pr. gun, and remains at one or two days' march in rear of the army. The above number of rounds, with those with the battery, makes up 500 rounds per 9-pr. gun, and 480 rounds per 16-pr. gun.

**Reserve, Militia**—A portion of the militia. A certain number, not exceeding the fourth part of the quota of the privates of the militia for England, Scotland, and Ireland, respectively, may volunteer to join this force. They may volunteer to be trained for 56 days in each year with the regular army, and in case of national danger or great emergency are liable to general service in the regular army.

**Residuum**—A term used to express what is left after the principal agent of any substance or body has been extracted; for instance, the impurities left after saltpetre has been thoroughly extracted from the crude substance.

**Resign, To**—To give up the service; to resign an appointment. In the former case, an officer must apply through his commanding officer for permission to retire. In the latter, an officer sends in his resignation through the prescribed channels. Non-commissioned officers are not allowed to resign their situation to escape trial by court-martial, except by special sanction of the general commanding. They can resign when they find themselves unequal to perform the duties of their rank, with the consent of their commanding officer.

In no instance whatever can an officer, non-commissioned officer, or soldier, presume to quit the service without having previously obtained the permission to do so.

**Resistance of the Air**—Besides what has been stated under the head of Air, Resistance of, the following further information may prove interesting, as gathered from the calculations of Captain W. H. Noble, R.A., from trials made with Navez-Leurs' electro-ballistic machine:—

"1. The resistance to the air is practically proportional to the square of the diameter of the projectile.

"2. Within the limit of 1200 and 1500 feet, the resistance appears to vary nearly as the velocity cubed.

"3. When the velocity of the projectile passes below 1100 feet, there appears to be a gradual, but at the same time rapid, reduction in the amount of resistance, as if the projectile were being rapidly relieved from some extra pressure. This rapid diminution ceases when the projectile reaches about 1000 feet.

"4. Within the limit of 1000 feet and 600 feet, the resistance appears to vary nearly as the curve of the velocity."

Captain Noble says, in his 5th paragraph on the same subject, that it is difficult to account for the rapid diminution of resistance between 1100 and 1000 feet.

But the difficulty appears subsequently to have been solved by Professor Haughton as follows:—"The air cannot follow a projectile at a higher velocity than that of sound; that, as long as the projectile travels slower than sound, the air closes in completely behind it by molecular propagation of impulse; but the moment that velocity exceeds that of molecular propagation (or sound), that moment there exists an imperfect vacuum behind the shot." "This," Captain Noble says, "would account for the rapid reduction in the resistance alluded to."

**Ressairdar**—A native officer in a native cavalry regiment who commands the left troop of a squadron.

**Ressalah**—The Indian term for a squadron of native cavalry.

**Ressaldar**—A native officer in a native cavalry regiment.

**Ressaldar-Major**—The native commandant of a regiment of native cavalry.

**Rest**—In a lathe, a piece of iron for holding the turning tool, fixed at the end of a slide by a set-screw; the slide can be moved at right angles to the bar of the lathe, and the whole can be fixed at any part of the bed between the centres.

**Rests**—In all campaigns certain pauses have to be noted in the march of an army, such as stationary positions, blockades, armistices, winter quarters. These are known as rests and halts.

**Retardation**—The resistance offered to any body in motion by the medium through which it moves. Thus a shot is retarded in its flight by the resistance of the air. (*Vide* Medium.)

**Retire, To**—To fall back from a position. *To retire under the guns* of a place is to take up a position under some fortress, for the purpose of being entrenched.

*To retire*, in another sense, is to leave the army. The following are the rules on the subject of retirement from the army:—

Agreeably to the regulations of the service, there is a certain time laid down in the British army before an officer can retire from the active branch of his profession, receiving the pay or pension attached to his rank or length of service. This period is after 30 years' service, when an officer can retire on full pay; after 25 years on half-pay. Medical officers attached to the army are permitted to retire on full pay after 25 years' service. In the Indian army, a full pay retirement or pension is granted to officers of the rank of captain, major, lieutenant-colonel, and colonel respectively, after 20, 24, 28, 32 years', and an increased pension after 35, and 38 years' service; to officers not belonging to the staff corps, after 22 years on the pension of their rank (on the Regulations of 1796). After 38 years, officers of the line and cavalry receive their colonel's allowance if they have served 12 years in the grade of lieutenant-colonel. The pension after 38 years is available for all officers, but it would probably only be taken by officers of engineers and artillery late of the Indian army, as they do not receive the colonel's allowance, like the infantry and cavalry, after a fixed period of service.

**Retired Flanks**, *vide* Flanks, Retired.

**Retort**—A chemical vessel generally of glass, earthenware, porcelain, clay, iron, &c., in which some kind of distillation is carried on. A *receiver* is usually annexed to it for the purpose of collecting the products of distillation.

**Retreat**—The term *retreat* is given to a bugle-sound, followed by a roll of the drums, or sound of the trumpets of the cavalry, in camp or garrison; it is sounded every day at sunset, after which no trumpets nor bugles are to be sounded or drums to be beat, except at tattoo, or in case of fire or other alarm.

**Retreat, To**—To fall back from a position before the enemy. This is either done as a strategical movement or when, being beaten by the adversary, a compulsory retreat is unavoidable. Falling back is always a delicate operation, and to effect a masterly retreat speaks more for the general's capabilities than even a victory.

To retreat with a harassed and broken army is the most difficult position a commander can be put in: discipline deserts his troops, confusion sets in, and nothing is left him but to seek his reserves, and so to rally his men against the pursuit of the enemy. The increased range of ordnance and small-arms nowadays renders retreating still more precarious.

In carrying out a retreat, it is necessary to form a strong rear guard—so strong that it shall be able to fight independently, should the enemy come up with it, thus enabling the main body to have time to rally and to take up a position ready to attack the enemy. Again, in having a strong rear guard, it not only keeps the pursuers at bay, but enables the artillery train and baggage to pass defiles, cross streams, and overcome all obstacles incidental to a retreating march.

**Retrenchments**—In fortification, are inner defensible lines to cut off a trench or other weak point, so that the capture of the lines shall not involve that of the retrenched post.

Retrenchments are also described as a short line of works constructed inside a large work, in order to enable the defenders to resist the enemy after he has penetrated the outer line.

**Returns** — Documents which are required periodically or otherwise from every regiment and department of the army, and which embody in their respective branches all the information required by higher authority.

**Reveille** (French, *réveil*, awaking)—Beat of drum or bugle sound, as a signal for the troops to rise. In England, the hour to turn-out is 5.30 in summer and 6.30 in winter, after which the sentries cease to challenge.

**Reverberatory Furnace**, *vide* Furnace, Reverberatory.

**Reverse Fire** — In gunnery, when the shot strikes the interior slope of the parapet at an angle greater than 30°, it is called *reverse fire.*

**Reverse Flank**, *vide* Flank, Reverse.

**Revetment** – In a permanent fortification, the masonry support afforded to the banks of earth on each side of the ditch, backed interiorly by buttresses. The escarp and counterscarp are such revetments. In field fortification, the materials used for the revetments are gabions, fascines, sandbags, and occasionally sods, hurdles, casks, wood, planking, &c.

**Revictual, To**—To throw stores, ammunition, and provisions, into a fortified place, when invested.

**Review**—In a military sense, is the inspection of a body of troops by the sovereign or any other high personage, or by the general in command. The programme generally comprises a "march past" (*q. v.*) in column, and subsequent manœuvres in imitation of a battle.

**Revolver**—A pistol having revolving mechanism attached to the breech, hence the name given to this peculiar kind of fire-arm. It consists either of many chambers with a corresponding number of barrels which revolve, or of one stationary barrel with chambers which alone revolve. By a certain mechanical arrangement in the latter kind of revolver, which is now the most common, the chambers revolve, and are brought successively under the action of the trigger, and after the discharge of one chamber another succeeds, and thus several shots can be fired without the necessity of re-loading.

Revolvers are no new invention; some were invented, it is stated, as far back as the seventeenth century.

The most modern revolvers are *Colt's*, *Adams'*, and *Deane's*. The *Colt* was invented by Colonel Samuel Colt, and brought out in 1835. It consists of a rifled barrel of considerable strength, of a diameter of bore of 0·358 inch, 7 grooves, and with a twist of 1 in 36, and of a massive breech perforated with six chambers, which are brought into line with the barrel by the action of the trigger. Each chamber has its nipple for a cap, which is brought under the hammer by the same motion that brings the chamber round. In the latest inventions this capped nipple has disappeared, the cap being contained within the cartridge. The hammer is discharged by the trigger, and acts nearly horizontally in a forward direction.

The *Adams* and *Deane* revolvers are similar in many points to the above, with this difference that there is a spur behind the trigger which must be pressed by the middle finger, while the forefinger through the trigger discharges the piece. The diameter of the bore of the Adams revolver is 0·443, and that of Deane's, 0·434, with 5 grooves and a uniform twist of rifling of 1 in 24 and 1 in 20 respectively.

The revolver principle has been successfully applied to the manufacture of a revolving gun for small projectiles known as the *mitrailleur* (*q. v.*). (*Vide* Appendix F.)

**Revolving Gun** — A breech-loading machine devised for fog signalling, to avoid the labour of sponging and ramming home, as in the common guns formerly used for that purpose.

The fore part consists of a barrel open at both ends; the breech front abuts in a close-fitting joint against the mouth of a chamber, formed in a horizontal wheel containing five chambers. A passage communicates through the top of the breech-carrier with the rear of the chamber next to the barrel. This passage is so arranged by means of a catch-spring that the communication is interrupted, except when a chamber is exactly fitted to the barrel, and then only can the gun be fired.

This gun is not adapted to warfare, being constructed merely to fire blank cartridge. The weight of the gun is 35 cwt.

**Reward**—A recompense given for good service. Rewards are either *honorary* or *pecuniary*. Of the former, titles, orders, and crosses are conferred on officers and men as marks of distinction for gallantry and good conduct and services rendered to the country. The most recent reward for military merit is the Victoria Cross (*q. v.*). Of the latter, is the good-service pension.

This reward is an annuity generally of £100, and is granted to general or field officers who have passed a distinguished military career either in the field or in good service to the state. It can be enjoyed by the recipient, in addition to his regular pension, until he succeeds to the colonel's allowance. In the Indian army, an officer receiving an enhanced pension, in addition to his regular pension, would not be allowed to retain the reward for distinguished service if the aggregate sums received by him exceeded £1000 a year.

Meritorious non-commissioned officers receive good-conduct rewards in the shape of annuities of £10, £15, or £20 each.

**Ribands**—Scantlings of wood about 15 feet long and 4 inches square, and used in rack-lashing gun platforms to keep the platform secure; they are also used for mortar platforms. Two ribands accompany each platform.

**Ribaudequins**—The name given to *organ guns*, which consisted of a number of tubes placed in a row like those of an organ, evidently the forerunners of the modern *mitrailleurs*. (*Vide* Orgues.)

**Ricochet Fire**—The bounding course of a projectile fired at a low angle in the field, not exceeding 3°, or in the ricochet of a fortification not exceeding 10°. As explained by Lieutenant-Colonel Owen, R.A., "ricochet fire consists in placing a battery at right angles to the line of troops or works aimed at, as in *enfilade*, but the shot having to clear a parapet which covers them, it is necessary to fire with a reduced charge and greater elevation, so as to give the shot a low * velocity and a high curve, in order that it may be brought down immediately after clearing the crest of the parapet, and then by rebounding along the face of the work, dismount the guns, or rake the line of troops under cover, as the case may be. The ordnance best adapted for ricochet fire are the 8-inch shell guns of 52 or 50 cwt., but any rifled gun throwing an elongated projectile which is capable of holding a large bursting charge might also be used to drop shells into a battery so as to burst on grazing; the path, however, of an elongated projectile is so eccentric after grazing as to render it not so well adapted for ricochet fire as he balls of smooth-bore pieces."

---

* But it is now generally acknowledged that it is far better to rely upon the explosion of a shell than on the bound of a shot moving slowly.

**Ride, To**—In horsemanship, to be arried on horseback. To insure a uniform system of equitation throughout the avalry, non-commissioned officers and oldiers are selected and sent to the depot at Canterbury to be trained as riding nstructors in their corps.

In artillery, *to ride* has reference to a rope when one part overlaps another on a capstan, windlass, &c., when it is said *to ride*.

**Riding Establishment**—A school at Woolwich, established for the instruction of the men of the artillery in riding. It was formed on the organisation of the horse artillery under the Duke of Richmond, when master-general. It continued, as a mixed department, with the royal artillery until the year 1809, when it was made into a distinct establishment. It consists of 7 officers, 218 men, and 144 horses.

**Riding the Wooden Horse**—A punishment formerly much resorted to, not only in the British army, but in the armies of other nations. The horse is described as "made of plank, roughly nailed together, forming a sharp ridge to represent the back of the horse; it was then supported by posts to serve as the legs of the animal, about 6 or 7 feet long, the whole being placed on a movable truck. When a soldier or soldiers had to undergo punishment, they were placed on this horse, with their hands tied behind their back, and frequently muskets were tied to their legs, to prevent the horse, as was humorously observed, from kicking off."

**Riding-master**—An officer attached to a cavalry regiment, or to the other mounted branches of the service; he instructs officers and men in riding and the use of their horses. He is commonly selected from the ranks, and has the relative rank of lieutenant. After 30 years' service, of which 15 must have been as riding-master, he can retire on 10s. a day, with the honorary rank of captain.

**Rifle**—A musket or carbine, the barrel of which is provided with grooves for the purpose of giving a rotatory motion to the projectile, thus obviating the defects so apparent in the fire of smooth-bore arms. As early as 1498, the citizens of Leipzig possessed the germ of the future rifle, for their arms had a grooved bore, but the grooves were straight. Later on, in 1520, Augustin Kutter, of Nürnberg, was celebrated for his rose- or star-grooved barrels, in which the grooves had a spiral form. This, then, may be said to be the origin of the rifle of the present day.

In the British army, as well as in all the continental armies, a breech-loading rifle is now the general arm in use (*vide* Foreign Armies); but the introduction of it is of comparatively recent date. The rifle formerly used, and then only in small numbers in the British army, was a two-grooved arm, a muzzle-loader. During the American war in 1812, the Americans, in the contest with England, appear to have used rifles with deadly effect from behind hedges and other cover, picking off large numbers of officers and men of the British force.

It may not be uninteresting to the reader to know the circumstances under which the change from muzzle-loading rifles to breech-loaders took place in the British army.

In July 1864, a committee on small-arms was appointed by government, which recommended that it would be desirable to arm the British soldier for the future with a breech-loading rifle. The question then was as to the means of carrying out the recommendation. It was suggested that the Enfield rifle (*q. v.*) should be converted, pending the more important question of a totally new arm being introduced into the service. It was proposed also at the same time that, in the conversion of the Enfield rifle, the principle of separating the shooting part of the gun—viz. the barrel—from the loading part, or breech, should be distinct questions; and upon this principle was settled the conversion alluded to, which guided the government ultimately in its selection of the Martini-Henry rifle (*q. v.*).

The question of conversion having been settled, and the arms having proved satisfactory, the government were enabled to take their own time in maturing a new arm, which, notwithstanding the efficiency of the Enfield, was not lost sight of.

As is well known to all soldiers, the Snider-Enfield rifle proved a success, and was pronounced by the breech-loading committee "a most efficient military weapon." The cartridge (Boxer's) also proved satisfactory, upon which, as Captain Majendie observes, "the success of the system must in a great measure hinge." From further experience, however, of the Snider rifle, derived in the handling of the converted weapon, it was found that the breech-loading apparatus had this defect, viz. that the breech was not secure in the event of explosion; for though no very heavy percentage of casualties had occurred from this cause, there had been sufficient to illustrate the disadvantage of a non-safety breech.

Notwithstanding this imperfection, the Snider breech-loader would probably have remained the service arm of the British soldier, "could it," as Captain Majendie observes, "have held its own against the numerous improvements of an active age." "But," as he further remarks, "was it reasonable to expect that the ingenuity which for some years has been concentrated upon the production of a good breech-loader could suggest no improvement in an arm of which the breech action (which, moreover, was hampered with the condition of its application to existing arms) was adopted in 1866, before the period of unexampled activity in this direction, and of which the shooting apparatus had been adopted in 1853, sixteen years ago?"

It having been determined, therefore, that a new breech-loader should be introduced into the service, possessing the conditions required by the committee, viz. accuracy, low trajectory, and non-liability to fouling, with the greatest perfection and simplicity of breech apparatus, the government offered a reward for the best rifle and cartridge. A large number of arms was submitted by various inventors for competition, which resulted in the Martini and Henry rifles being considered as the arms best answering the required conditions. In the exposure test it was found that the Martini mechanism had slightly the advantage of the Henry; but the rifling of the latter was accepted as the "most suitable in all respects for the requirements of the service." Thus it came to pass that an alliance was made between the Henry barrel and the Martini breech to give us the arm of the future, and this was recommended by the committee.

The trials made with this rifle show incontestably that we have got an arm which at 500 yards is 25 per cent. better than the Snider, and which, as regards rapidity, can fire 25 shots a minute. (*Vide* Appendix F.)

**Rifle Association,** *vide* Volunteers.

**Rifle, Magazine**—A breech-loading rifle, having a tube in the stock in which a series of cartridges is inserted, which, by a simple action, pass into the barrel for discharge. The best known magazine rifles are the Spencer, the Winchester, and the Vetterli rifles (*q. v.*).

**Rifle Pits**—Holes, or short trenches, capable of containing one man, and in the shape of an inverted frustum of a cone, with a seat in the rear; the top of the breastwork is made by placing two sandbags across the parapet, and a third resting on these in the direction of it, to cover the head and shoulders of the rifleman. A man should be able to complete a pit in one hour.

The diameter of the top and bottom respectively is 4 feet 6 inches, and 2 feet 6 inches, while the depth is 4 feet.

**Rifle Regiments**—The regiments so designated are the *Rifle Brigade* and the 60*th Regiment*, which were originally armed with rifles, when the majority of regiments were armed with smooth-bore muskets; and though the whole army is now furnished with rifles, these regiments still retain their designation and clothing (dark green).

**Rifled Ordnance,** *vide* Ordnance.

**Riflemen, Mounted**—Or, in other words, mounted infantry, the designation of riflemen being given to them from the arm they were equipped with. Mounted riflemen are soldiers trained to act as foot and cavalry soldiers. This arm is unknown at the present time in the British service, but since the war of 1870–71, which has confirmed the opinion held by many soldiers, that "mounted riflemen are now essential to every enterprising army," the subject of reintroducing it in the army has been often discussed.

The first mention in military history of mounted riflemen is that of the dragoons created by Maréchal de Brissac in 1600.

They were foot soldiers mounted on horses, who on emergencies carried a comrade *en croupe*. The first official record of such troops in the British service dates from a royal warrant of 1672, which regulates the matchlock as one of the arms. The Scots Greys, who were raised in 1683, carried also fire-arms, as well as the British dragoons of the seventeenth century; both were instructed to act as infantry on horses, to enable them to make more rapid movements. Dragoons, acting as such, were eventually changed into cavalry; and the last corps bearing the name of mounted riflemen was that at the Cape, which was disbanded a few years ago. This nature of mounted infantry has been reintroduced in the volunteer forces of the country, there being four small bodies of mounted riflemen.

Mounted riflemen were considerably used and appreciated by Napoleon I. and his generals. Jomini writes on the subject as follows: "It is certainly an advantage to have several battalions of mounted infantry, who can anticipate an enemy at a defile, defend it in retreat, or scour a wood." Sir G. Wolseley, in writing on the subject of outposts, gives it as his opinion that, whenever mounted infantry is introduced into our service, and its employment properly understood, these outpost duties will devolve to a very considerable extent on it. Such men are invaluable in covering retreats; to seize, destroy, and hold bridges; for works of destruction, such as removing rails and telegraphs, &c. For these duties they were frequently employed in the American and the last continental wars, most foreign armies having adhered to that system. Colonel Hamley says, in his 'Operations of War,' second edition:—"As cavalry alone could effect nothing in an intersected country, or against a body of mixed troops, or a force sheltered by obstacles, it is indispensable that the troops thus employed, while mounted for the sake of celerity, should be able to meet infantry on good terms. Their chief action must therefore be as infantry, the horses of the dismounted men being held by their comrades. . . . Mounted infantry is altogether a different thing from dismounted cavalry, and the two kinds of force should be kept carefully distinct. All experience has shown that cavalry who are habituated to rely on their fire-arms are apt to lose their distinctive characteristics of promptitude, impulsion, and resolution in attack; and it would be impossible, by any amount of training, to combine such opposite functions in the same troops. By establishing mounted riflemen as a separate arm of the service, men and horses of a size which, though admirably suited for rapid and sustained movements, is deficient in the power and weight that tell so formidably in the charge, might be turned to excellent account."

Colonel Hamley further states that on this kind of troops might properly devolve the business of reconnoitring or heading the advanced guards, of seizing defiles, &c. On the other hand, the regular cavalry, spared in great measure the harassing duties which fritter away its strength, would be preserved intact for the day of battle.

In a country like India, infantry can be mounted on camels, and has been so utilised when it was desirable to send troops on a forced march to take a place by surprise, or to scatter a collecting force. Each camel carries two men. It would be necessary on such service to dismount, and rest the men during the journey. But except for the expense there is no reason why there should not be a permanent corps.

**Rifling**—The act of cutting two or more grooves in the barrel of a gun or of a small-arm. A citizen of Leipzig appears to have been the originator of the mode of rifling. Some attribute the first invention of a rifle to Gaspard Zuller, of Vienna, in the fifteenth century; others to a gunmaker of Nürnberg, in 1520; and Denmark, it is also stated, introduced the system of rifling in 1545. However, be this as it may, the great advantage and effect of rifling was not known until the middle of the last century, when Robins, in his tract, in 1747, on 'Rifled-barrel Pieces,' explained not only the advantage of rifling, but the effect of spiral rifling over the system of straight rifling, as introduced by the first inventors. Robins' tract not only remarked on the value of rifling, but suggested the shape a projectile should be, viz. elongated; and gave it as his opinion that whatever state should thoroughly comprehend the nature and advantages of rifled barrel pieces would acquire a superiority to the advantage of the state using them.

Captain J. B. O'Hea, late 25th King's Own Borderers, in his lecture at the United Service Institution in 1873, on the subject of rifles and rifling, defines a rifled barrel as follows:—"A rifled barrel or tube is literally nothing more or less than a compound mechanical power, i. e. a female screw, the nut through which a bolt (the projectile) is driven with more or less velocity, according to the power applied to it, and as the pitch and form of screw afford more or less facility for its transmission. This, whether the projectile be a perfect or imperfect sphere, a rifled cylinder for its whole length, or only in part. In any case, the projectile becomes the male screw if, when passing through the bore or any part of it, its surface is made to conform, in any way, or by any means, to the incline of rifling. Whether this conforming is effected by expansion at or ramming down from the muzzle, as in early rifles (and indeed in those used far into the present century); by expansion at the breech caused by ramming on a pillar on Colonel Thouvenin's plan, or by a cup or plug inserted at the base of the bullet; whether the projectile is made to conform to the pitch of rifling by means of a sabot, as in the Prussian gun, or by a jacket of leather, paper, or other material, or is compelled to follow the rifling by studs, grooves, ribs, &c.; in every case where the surface of the projectile is made to rotate in the bore round its axis of progression the projectile is the male, and the barrel, being the means, is the female screw."

What is termed the pitch of rifling (*q. v.*) is the angle at which the grooving of the barrel is formed. This and the number of the grooves, which is termed the pattern of rifling, depend on the fancy or system of the inventor. These may be classed under three or at most four systems: (1) the ordinary land and groove pattern; (2) the elliptical or *Lancaster* system; (3) the polygonal or *Whitworth*. All other patterns appear to be offshoots or modifications of the above systems.

With reference to the manufacture of rifles, the rifling is performed by a machine, especially adapted for this operation. The 'Text-book on the Construction of Rifled Ordnance' explains how this machine performs its work. "In order that the tool in the rifling machine may cut a spiral groove in the gun, it is necessary that it should have given to it a motion of rotation as well as that of progression. Did it simply progress along the bore, a straight groove would be made, and did it rotate without moving forward, a ring would be cut round the bore. Now, by combining these two motions, and regulating the ratio of the rotation to the progression, a spiral of any required pitch can be obtained."

The forms of rifling used for M.L.R. guns in the service are—(1) Woolwich; (2) plain groove; (3) French; (4) French modified; and (5) shunt; the latter will be gradually abolished, but a large number of guns still retain this form.

**Rig, To**—In artillery, to fit up; an expression made use of in fitting up a gyn or capstan for working, &c.

**Right Angle**—In geometry, is that formed by a line falling perpendicularly on another, or that which subtends an arc of 90°.

**Right Ascension**—In astronomy, the arc of the celestial equator intercepted between the first point of Aries and the circle of declination passing through the body. The right ascension is always measured from west to east, entirely round the circle.

**Rimer**—A steel tool of four, five, or eight sides, for drilling holes in iron work. It is also a conical bit of the shape of the fuze hole of a shell, used formerly for giving the shell the proper dimensions and finishing off.

**Ring Bone** — Mayhew, 'On the Horse,' describes it as "a bony deposit in one of the pasterns of a horse's foot. It is principally confined to draught horses which have to drag heavy weights up steep ascents. The entire force is then thrown upon the bones of the pastern; inflammation ensues; lymph is effused; the lymph becomes cartilage, and the cartilage is converted into bone. Then an exostasis is established, and a ring bone is the consequence. *Remedy.*—Apply poultices on which one drachm of powdered opium and one of camphor have been sprinkled. Rub the disease with equal parts of oil of camphor and of chloroform. Then, after the pain has ceased, apply the following ointment night and morning:—

Iodide of lead, one ounce.

Lard, eight ounces."

**Ring, Broadwell's**—A means of preventing the escape of gas in a B.L.R. gun. It is the invention of an American, and is used in Mr. Krupp's and other guns.

**Ring Gauges,** *vide* Gauges, Shot or Shell.

**Riot**—A disturbance; a breach of the peace committed by any number of persons amounting to twelve or more. The military are often called upon to suppress riots, when an act, called the *Riot Act*, passed by parliament for prohibiting riotous assemblies, is read to the mob by a magistrate or police officer. If the rioters do not disperse in a given time, the soldiery may fire upon them, and reduce and disperse them by force of arms.

**River**—A large stream of water flowing towards the ocean. The course of a river is the natural tendency of water to obey the law of gravitation, by moving downwards to the lowest position it can reach.

Rivers play a very important part in the science of war, either as obstacles (*q. v.*) or as forming the frontier line between two states, and thus they can, either in a strategical or a political point of view, considerably alter the attitude of the belligerents. If these are only separated by a frontier line such as a river, the army that first crosses the stream by means of bridges, secured by bridge-heads, will always find itself immensely superior to the force that can interpose it, as it gives the enormous advantage of being able to penetrate the enemy's country at pleasure, to carry therein an offensive warfare, or to retreat safely in case of a reverse. Military history affords many interesting instances of the advantages obtained by generals having succeeded in crossing rivers, whether the Rhine, the Danube, or the Potomac, that separated them from the enemy, as well as the different manœuvres carried *on by those* who were entrusted with their defence in order to foil these attempts.

As obstacles, rivers present many advantages, as the defenders can deploy, so as to bring an overwhelming and convergent fire, both of small-arms and artillery, to bear upon an enemy attempting to cross them. Their defence is safer than that of mountain passes, but, on the other hand, in a rich country, they offer to the enemy increased means of crossing, and at the same time they screen his movements. The examination of rivers is therefore of the utmost importance in time of war, and this can only be done by means of reconnaissances (*q. v.*).

The passage of rivers can be accomplished by various means, such as bridges, pontoons, boats, fords, &c., and in time of war, in the case of large streams which are unbridged, this duty belongs to the engineers. (*Vide* Pontoons.) It is a very difficult and hazardous operation, and demands a superiority of force, especially of artillery, and for this reason, generals endeavour to gain a footing on the opposite bank by manœuvring. But in case a small body of troops, unaccompanied by engineers, should find its progress stopped by a small but unfordable stream, the officer in command should endeavour to find boats of a sufficient size to ferry the troops and the baggage across; if not procurable, such small boats as can be obtained may be used to form a floating bridge, or, if not sufficient for a bridge, to form a raft. The carts, especially corrugated iron, which may accompany a force, can be easily floated across a river by unloading them, and simply fastening an empty barrel underneath each. Other materials, such as casks, barrels, trees, may be put together to form floating supports for a platform or a raft. The materials necessary for these constructions can be obtained from adjacent buildings or woods, and among the soldiers a few carpenters may be found to put them together; but only small streams can be crossed by troops who are marching without the usual pontooning equipment.

The swiftness of a river varies according to the height of the water, and is generally more rapid where the bed is the deepest, but varies according to its depth or its breadth.

The following method is given as the simplest to ascertain the swiftness of the current of a river. Set two flags on the bank at any convenient distance from each other and parallel to the direction of the current. Throw into the *Thalweg*, or the line that follows the lowest part of the valley in which the river flows, above the upper flag, a piece of wood or cork, which will be but little affected by the wind. Observe very accurately the time taken by the floater in passing from one flag to the other. Repeat the operation several times and take the mean.

The mean velocity can be found by the following formulæ:—

Let U be the swiftness at the surface (measured as above), V the mean velocity; then—

If U is less than 1·2 foot per second, $V = 0{\cdot}75\,U$
If U is between 1·2 ft. and 4 ft. „ $V = 0{\cdot}84\,U$
If U is between 4 feet and 8 feet „ $V = 0{\cdot}85\,U$

or again the mean velocity of water in rivers $= \dfrac{(\sqrt{V} - 1)^2 + V}{2}$, where V is the superficial velocity expressed in inches.

A river is said to be sluggish when it flows at the rate of 1 foot 6 inches per second (about 1 mile per hour); ordinarily swift, from 2 to 3 feet per second (about 2 miles per hour); rapid, from 3 to 5 feet per second (about 3 miles per hour); very rapid, from 5 to 8 feet per second (about 5 miles per hour); a torrent, from 9 feet and upwards (about 6 miles per hour and upwards).

A *fordable river* is a river which may be passed without the assistance of any floating machines or bridges. (*Vide* Fords.)

**Rivets**—Short bolts of metal inserted in a hole at the juncture of two plates, and after insertion hammered abroad at the ends so as to keep the plates together.

**Rivetting Machine**—By this machine, the invention of Mr. Fairbairn, the work of rivetting metal plates together is done by an almost instantaneous pressure, and without any noise. The boiler or any other work is suspended between a die on the upright post, when a moving slide and die worked by the action of a revolving cam upon an elbow joint closes the work and finishes the rivet.

**Roadway**—In military bridges, is that part of the bridge or pontoon, placed on the longitudinal bearers between the handrails, which admits a clear passage of troops or material. Roadways differ in size according to the dimensions of the bridge.

**Rock Oil**, *vide* Naphtha.

**Rocket**—In its commonest form, is nothing more than a species of firework, and is commonly used in all pyrotechnical displays. For military purposes, there are two natures of rockets—the *signal rocket* (*q. v.*) and the *war rocket*, the latter known as *Hale's rocket* (*q. v.*), which has superseded Congreve's rocket.

Lieutenant-Colonel Owen, R.A., in his lectures on artillery, gives the following general description and principle of a rocket:—

"A rocket consists of a cylindrical case of paper or metal containing an inflammable composition; to the end of the case is attached a head usually of a conical or cylindro-conical form, and the other end is closed, but has one or more vents or holes in it, for the escape of the gas, from the ignited composition.

"The composition is driven into the case over a conical spindle, passing to a certain distance up the centre, thus leaving a hollow space in the interior of the rocket, the base of the hollow cone coinciding with that of the rocket.

"The object of having this cavity in the interior of the rocket is that a large surface of composition may be at once ignited when the rocket is fired, and so great a quantity of gas generated within the case that it cannot escape from the vent as quickly as formed, and therefore it exerts a pressure in every direction on the interior surface of the rocket. The pressures on the sides of the rocket mutually balance each other, but the pressure on the head is greater than that on the base, in consequence of the escape of gas from the vent or vents; it is this excess of pressure on the head over that on the base which causes the rocket to move forwards, this being merely a similar action to the recoil of a gun fired.

"A stick or long rod is attached to the base or side of the rocket in order to unteract, by the resistance of the air on it, any tendency to turn over, and maintain the rocket during its flight nearly as possible in the direction in hich it is fired; when accuracy is reired, the stick should be strictly in olongation of the axis of the rocket."

The following history of the introction of rockets into the British serce, as extracted from the *Times*, will ubtless be found interesting to the litary student:—

"The rocket was first introduced into e British service in 1806 strictly as . incendiary projectile. At this period e only means of bombarding and burng towns and shipping was by mortar e, for although shells were fired from witzers with small charges about 1700, was not until 1822 that General Paixns pointed out the proper use of shellns for horizontal fire. In the early rt of this century, therefore, bombardents were effected by discharging either mmon shells or carcasses—projectiles lled with inflammable composition—om comparatively ponderous pieces of dnance, such as 13-inch, 10-inch, and -inch mortars. The 10-inch sea service ortar weighed over 50 cwt., and fired spherical carcass-shell of 105 lbs., lled with about 7 lbs. of composition. he latter was ignited by the discharge f the piece, and burnt very fiercely for bout nine minutes, the flames issuing om three vents. This projectile, therere, on falling among combustible mateal, produced a conflagration, but such as the force of its descent from the height which it had been thrown by the morar that, on falling upon a building, it equently went through the roof and ll the floors of the house, until it ultiately buried itself in the cellar, where ere was nothing combustible. The -pr. rocket, on the other hand, also ntained about 7 lbs. of carcass comsition in its head, but was about e-third of the weight of the 10-inch ell. It could be easily carried by one an, and discharged by means of a tube a simple and light construction. oreover, it would range even farther an the 10-inch shell, and, owing to its mparative lightness and shape, would dge somewhere inside the body of the house it struck; it was therefore more likely to cause a conflagration. Rockets appear to have been first used by us in the bombardment of Boulogne in 1806, when 200 rockets were discharged and the town set on fire in many places without the slightest opposition or loss being incurred by the attacking party. They were subsequently used with great effect during the siege of Flushing.

"But, although Sir William Congreve's first idea was an incendiary projectile which was to be thrown in large numbers from boats into a seaport town or a harbour crowded with shipping, the system gradually expanded until it comprehended military as well as naval operations. The 32-pr. rocket was after a time abolished, and 24-prs., 12-prs., and 6-prs. introduced, and in 1813 rocket troops of royal artillery were formed. The service rendered by the rocket detachments attached to the allied army at Leipzig is a matter of history. In telling the story of the battle, Sir Edward Cust says that the destructive effect of the flights of rockets was so fearful that a whole brigade surrendered after being a few minutes under their fire. But this was by no means the first occasion on which rockets were used against troops. They had long been known to and used by Eastern powers, and Tippoo Saib taught us the value of the rocket as a projectile during the siege of Seringapatam in 1799, when the British troops are said to have suffered more from the enemy's rockets than from shells or any other weapon.

"Thus by degrees the rocket was generally adopted as an engine of war both for naval and military purposes, and gradually its original object came to be lost sight of. Carcass rockets went out of fashion, and shell rockets were introduced with time fuzes and all the paraphernalia for boring them. The cast-iron head of the rocket was fitted with a fuze next the composition and a small hole in the apex for the insertion of the bursting charge through which the boring machine —somewhat similar to a bit and brace— was introduced when it was required to bore into the fuze composition. When the rocket was to act as a shell, the screw plug in the apex was removed, and the fuze composition bored into for a depth corresponding to the distance at which the shell was required to burst; the bursting charge was then poured in and the screw plug replaced. Now this operation was a work of time, and the service of the rocket was proportionately delayed. Moreover, the shell-head even of the largest size rocket, the 24-pr., only contained about 9 oz. of gunpowder, while that of the 12-pr. did not hold half that quantity. These considerations led the ordnance select committee in 1866 to recommend that the use of war rockets as shells be discontinued, and when Hale's rockets were introduced in the following year, the hollow in the cast-iron head was simply plugged up with a piece of oak. In fact, as at present manufactured, the rocket, as a man-killing projectile, acts mainly as a shot, while its incendiary powers are confined to the flames which issue from its tail—that is, to the burning of the rocket composition, which only lasts a few seconds. We readily join with Sir Samuel Baker in deprecating this arrangement. This form of artillery appears to us to have neither soul nor body. We by no means wish to reintroduce fuzes and thus complicate the service of rockets, but we think the piece of wood in the head might be advantageously replaced by gunpowder or, perhaps, by a more powerful explosive—picric powder, for instance. The wood is a perfectly inert substance, and is of no value whatever, whereas the gunpowder would, at any rate, blow the cast-iron head to pieces when the composition had burnt out, and might thus cause some destruction. But the modification we should like best would be a return to our first love. We have introduced rifled guns without adopting a special incendiary projectile (common shells excepted), and it seems to us that rockets might be made to undertake this *rôle*. Thus the primary object of Sir William Congreve would be kept in view. Possibly, even the principle of the rocket may be successfully applied to the transmission of torpedoes either under water or through the air, but in any case the destructive powers of the engine should not solely depend upon its *motive power*. Sir Samuel Baker appears *to have just* cause of complaint when he points to the non-incendiary powers of the Hale rockets used by him, and, although the rockets supplied to the Gold Coast expeditionary force appear to have acted well in a man-killing sense, still Sir Garnet Wolseley would undoubtedly have found less difficulty in setting fire to Coomassie if these engines had a carcass head instead of a wooden one."

**Rocket Drifts,** *vide* Drifts, Rocket.

**Rocket, Life-saving,** *vide* Life-saving Apparatus.

**Rockets, Congreve**—Rockets known, up to a late date, as the war rockets of the service. They are now obsolete.

**Rockets, Hale's**—The war rockets now used in the British service. They were introduced in 1867, superseding the Congreve rocket. They are the invention of Mr. Hale. These rockets are described as "made of Atlas metal, formed into a cylinder corrugated in three places, to prevent the composition from giving way in flight. Originally the cases were made of drawn tubing, which was liable to split. The head of the rocket is made of cast iron, filled with oak and secured to the body by rivets. The composition, consisting of pellets pressed into the case, having a conical hollow bored, is separated from the head by a mill-board disc, and from the base by a mill-board washer. The base of the case is closed by a cast-iron ring, tapped to receive a tail-piece of cast iron with three conical vents with the larger part of the cone towards the interior. The vents are cut away on one side, so as to leave three projecting wings against which the gas acts and causes the rocket to rotate. By this rotatory motion on its longer axis, with the pressure of the gas within the case acting with greater force on the head than on the base, the rocket proceeds forwards in its flight, point foremost, as in the case of an elongated projectile fired from a rifled cannon; no stick therefore is required as in a signal or Congreve rocket.

"The rocket is fired from a V-shaped triangle made of sheet-iron supported at the rear by three legs, two short ones opening right and left, and one long one to the front. The elevation is given by means of a ring sliding up and down the front leg (which is graduated) and clamping it. There are two natures of war rockets in the service, viz. of 9 lbs. and 24 lbs.—the former for service in the field, the latter to be used from fortresses."

**Rockets, Signal**—As their name implies, are used as signals between distant camps, forts, &c., and are most valuable on account of the distance they can be seen on a clear night, ascending to heights varying from 450 to 1200 yards, according to their diameter. It has been ascertained that they can be seen within a circuit of from 35 to 40 miles.

The case of the rocket is made of thick brown paper, and is capped with a cone-like head; in the case is the composition, in the head the composition of the stars. Rockets are fired from stands, and in a perpendicular position. Those used in the service are of two sizes, viz. 1-prs. and ½-prs.

**Rod Lead**, *vide* Lead, Rod.

**Rodman Gun**—A cast-iron gun, the invention of Captain Rodman, of the U.S. army. His invention lies in the mode adopted for gradually cooling the metal while in the process of casting, which, it is said, produces great hardness round the bore.

A 15-inch gun of his manufacture was tried in 1867 at Shoeburyness, but the result, though fair, was not sufficiently encouraging to recommend its introduction into the British service.

**Rodman's Pressure Gauge**—The invention of the officer whose name it bears, and the inventor of the Rodman gun; the gauge is used for determining, as described by Lieutenant-Colonel Owen, "the absolute pressure of the gas in the bore of a gun, the metal of which is perforated at different distances. Into each hole a *pressure gauge* is screwed, consisting of a piston, an indenting tool, and a disc of copper; when the piece is fired, the piston, one end of which projects as far as the bore, being exposed to the pressure of the gas, is forced outwards, and presses the tool—having a broad but thin point—into the copper disc, the indentation made being compared with that obtained in a testing machine with the same tool, and a piece of copper cut off the same bar."

An improvement upon this gauge was made for the use of the committee on explosives, called a *crusher*, the pressure of the gas being ascertained by the compression of a copper cylinder upon an anvil by the piston.

**Roll of a Drum**—A continuous and uniform beat of the drum for a certain time. What is known as the *long-roll* is a beat by which troops were formerly assembled at any particular spot of rendezvous or parade.

**Roll-call**—In military life, it is necessary, for the sake of discipline and to prevent soldiers from wandering about indiscriminately at all hours, as well as for the purpose of having them available at any moment in case their services are required, that the men of a regiment, company, or detachment should be present to answer their names during certain fixed periods of the day, or at any time the commanding officer may think advisable. This is termed *roll-call*.

**Rollers**—Solid cylinders of wood, used in mounting and dismounting guns, in shifting them from carriage to carriage, and in moving them upon the ground, or shifting a siege gun from the firing to the travelling holes. There are three descriptions, *ground*, *shifting*, and *gun*. Their dimensions vary, according to the nature of the service for which they are intended.

The name is also given to massive rollers of iron, weighing about 4½ tons, having faces 18 inches broad, which are used in the incorporation of gunpowder. They are termed *edge rollers* or *runners*. (*Vide* Runners.)

**Romans**—The following quaint custom, extracted from James' 'Dictionary,' may not be without interest:—"Before the establishment of the mess at the Horse Guards, which was formerly paid out of the king's privy purse, and subsequently charged in the extraordinaries of the army, the captain of the guard at St. James's kept a table for the subalterns attached to that duty. In order to enable the captains to support these expenses, a certain number of men were allowed to work in the metropolis, on condition that they left their pay in the hands of their officers; these men were called *Romans*."

**Rondel**—In fortification, a round

tower, sometimes erected at the foot of a bastion.

**Rope**—This name is usually applied to all cordage above 1 inch in circumference made of hemp, spun into yarns or threads, of a certain length; a number of yarns or threads, according to the size of the rope, are twisted together into a strand. Three of these strands twisted or laid together are called a *hawser-laid* rope, and nine of them a *cable-laid* rope. When the rope is made very thick, it is called a *cable*, and when very small, a *cord.* The following is also another definition of a rope:—"A rope consists of three strands, a strand of a certain number of yarns, and yarns are made of the hempen fibres. The number of the fibres making a yarn is not counted, but the yarn is estimated by the weight of the hemp in a given length. Fibres are *spun* into yarn, yarns are *registered* into strands, and strands are *laid* into rope. Rope-making dates from the earliest times. Various kinds of fibre have been used for the purpose, such as hemp and flax, tough grass, the husk of the cocoa-nut, the fibres of the wild banana, &c., and animal substances have been used, such as strips of an ox hide, horse hair, and wool. Ropes have also been made of metallic wire. The size of a rope is designated by the circumference or girth: thus a 3-inch rope measures 3 inches. The length is usually expressed in fathoms."

The strength of ropes is sometimes calculated by the following rule. Multiply the circumference of the rope in inches by itself, and the fifth part of the product will express the number of tons the rope will carry; in practice, a rope should not be subjected to more than half this strain. It stretches from one-seventh to one-fifth, and its diameter is diminished from one-seventh to one-fourth, before breaking. White rope is stronger than tarred rope, and only ropes that are to be immersed in water should be tarred. The strength of Manilla rope is less than that of hemp rope. The good quality of rope is sometimes discernible by its colour, which borders on silver grey, though this is not always a sure sign; a better test is its smell. Cordage of a strong odour should have the preference, and such as smells rotten, mouldy, or exhales heat, should be rejected. To store ropes, they should be placed in the upper stories of a building, coiled up and labelled; large ropes on skids, so as to allow the circulation of air, small ropes being hung up. Ropes should be uncoiled every year, and stretched out for several days at the beginning of the dry season in India. Rope is issued in coils of 120 fathoms each, marline and Hambro' line in skeins, and spun yarn in pounds.

Government rope is distinguished by a coloured thread, red, yellow, or blue, running through it. There are several descriptions of ropes which are used chiefly in the artillery service.

**Rope, Bowsing,** *vide* Bowsing Rope.

**Rope Bridge,** *vide* Suspension Bridge.

**Rose-engine**—Is described as "a peculiar kind of turning lathe having special chucks for the production of those patterns of curved lines called by the French *rosettes*, from the slight resemblance which they bear to a full-blown rose, and hence the term *rose-engine.* The rose-engine lathe differs from the common lathe in this, that the centre of the circle in which the work revolves is not a fixed point, but is made to oscillate with a slight motion while the work is revolving upon it, the tool being all the time stationary, and hence the figure will be "out of round," as the turners call it, or will deviate from the circular figure as much and as often as the motion is given to the centre."

**Rosin**—An exudation from trees belonging to the Coniferæ or fir tribe, and the residue left in the still, after the oil or spirit of turpentine has been distilled. It is very combustible, and is used in light-ball and carcass composition.

**Roster**—A list which regulates, in succession, the services of officers and men for regimental, garrison, and other military duties. For regimental duty, the officers' roster is kept in the adjutant's office; for brigade duty, in the brigade-major's office. This word was formerly spelt *rolster.*

**Rotation, Velocity of**—A term used in gunnery to express the speed with which a projectile rotates at the mouth of the piece or along any portion of its path, which varies with the charge and twist of the grooves. This velocity further depends upon the form, length, weight, and position of the centre of gravity of the projectile.

**Rotatory Motion**—In gunnery, is the motion given to a projectile fired from a smooth or rifled barrel. In the former case, in consequence of the eccentricity of round shot, the shot acquires a rotation of which the axis and direction are altogether uncertain; in the latter, the rotatory motion is acquired around an axis coincident with that of the bore, so that the direction of rotation is known. This fixed rotation adds greatly to the steadiness and accuracy of the projectile in its flight, and the deviation being a constant quantity can be allowed for by a scale of deflection, or the gun can be sighted "true," when manufactured, so that no allowance is necessary except for wind. Again, elongated projectiles offer less resistance to the air than spherical projectiles of the same weight, and consequently range further.

**Rough Rider**—In the artillery or cavalry, an instructor in equitation, and an assistant to the riding master. One is allowed to each troop or battery.

**Roughing**—A mode of treating horseshoes during slippery weather, when ice is lying on the ground. The old mode of carrying out this operation is considered an inconvenient and exceedingly injurious plan. A new method of roughing is recommended by Mr. George Fleming, a veterinary surgeon in the royal engineers, which consists in the insertion of a small, pointed, square plug of steel, measuring from 1 to 3 inches (nearly always the former) at the heel and, if desirable, at the toe also of each shoe, in a simple square hole punched at these points. The result is stated to be most satisfactory, horses being enabled, in the most frosty state of the roads, to do their work as in ordinary weather. The army horses at Chatham were so roughed during the winter of 1875, and nothing could have been more satisfactory.

The term *roughing* is applied to the action of a rasp on a fuze, to make it bite in the fuze-hole, and also in rendering the external surface of anything not smooth capable of taking a hold.

**Round**—In artillery, a "round of ammunition" comprehends the charge of powder, the projectile, and the priming or friction tube. *To fire one or more rounds* is to discharge each gun in succession from a battery or a portion of it, until the turn comes round for the first gun to fire again. Light artillery can come into action and fire one round in 28 seconds, timing from the order, "Action front," to the discharge of the piece; and in 15 seconds if the first cartridge and shot be carried in a box on the gun axle-tree. (*Vide* Rapidity of Firing.)

In a plural sense, the term is applied in gun-drill to the change of numbers in the gun's crew, comprehended in the order, "Change rounds." It is also applied to the number of small-arm cartridges carried by a soldier in his pouch or elsewhere, which is reckoned by rounds, as 40 rounds in pouch.

**Round Shot**—Spheres of iron or steel fired from smooth-bore guns.

**Rounds**—A duty performed by commanding officers of guards, which consists in their visiting the guards and sentries under their command. They should go their rounds at least twice a day and twice by night; and, in addition, a non-commissioned officer, with a file of men, ought frequently to visit the sentries, in order to ascertain that they are acquainted with their orders, and are carrying them out in a proper manner. The latter are called *visiting rounds*. Field officers of the day go what is called the *grand rounds*.

**Route** (French, *route*, a road)—An order for troops to march from one place to another. It expresses also the road by which they are to move. The *route* or line of march is appointed by the quartermaster-general of the army, under whose orders, by direction of the commander-in-chief, all transfers or reliefs of regiments take place.

**Route, Column of,** *vide* Column of March.

**Routine**—Capacity or the faculty of arranging; a certain method rather acquired by habit and practice than by study and rule. It signifies also a general custom or usage, established by habit, and followed mechanically and without reflection.

**Row, To**—In artillery, to move a gun in the direction of its length, by means of handspikes used with a rowing motion.

**Royal Academy,** *vide* Academy.

**Royal Arsenal,** *vide* Woolwich.

**Royal Cambridge Asylum**—An institution founded by the father of the present Duke of Cambridge, for the purpose of giving a home to one widow of each British regiment. It is not yet completed, and is only capable at present of receiving about 60 widows.

**Royal Scots, The** — The regimental title given to the 1st Regiment of Foot. It is supposed to be the oldest regular corps in Europe; the men originally came from Scotland, and entered the French army, but afterwards returned to England in 1633, during the reign of Charles I., and then received the title of Royal Regiment of Foot.

**Royal Standard,** *vide* Standard, Royal.

**Royal Warrant**—An act of the sovereign, authorising, for military purposes, the Secretary of State for War to issue rules and regulations for the guidance of the several departments of the army. Royal warrants, where the army is concerned, relate to all matters touching the soldier, his pay, clothing, travelling, food, &c., and are issued from time to time, by the War Office, in army circulars, for the observance of all concerned.

**Rubbers**—Strong heavy files, generally made of an inferior kind of steel; they measure from 12 to 18 inches long, from ¾ inch to 2 inches on every side, and are made very convex or fish-bellied. Rubbers are only for coarse manufacturing purposes, when the object is rather to brighten the surface of the work than to give it any specific form.

**Ruffle**—A low vibrating sound, which is beat upon the drum, but not so loud as a roll. It is generally performed in paying military compliments to general officers, and at military funerals.

**Rule** (Anglo-Saxon, *regol;* Latin, *regula*)—In arithmethic, denotes "a certain *prescribed* series of numerical operations, adapted to discover, from the given conditions to which an unknown number is subjected, what that number is. They are generally distinguished by particular names, according to the purposes for which they are given, or the particular nature of the business for which they are required; as the rules of interest, &c."

The word applies also to an instrument on which different scales are marked, and which is used for measuring, such as the *carpenter's rule*, a common 2-foot rule, jointed in the centre, for measuring timber. It is not only used by carpenters, but by other artificers. It has a variety of scales, to facilitate the calculations of most frequent occurrence.

*Gunner's rule.* — A rule made either of box or ivory, and jointed in three places, for the convenience of carriage, having various tables of weight and dimensions of S.B. guns, shot, shell, &c. marked on it.

**Runners** — Metal cylinders used in the incorporating mills of a gunpowder manufactory, known also under the name of *edge-rollers*. They were formerly made of gun-metal, but iron runners have been found to be equally safe, and are much cheaper. Iron runners, like gun-metal, become honey-combed after being in use for some time, from the action of the saltpetre, if the metal has not been properly hardened. They are about 7 feet in diameter, 18 inches broad (the face), and from 4½ to 5 tons in weight.

**Running Drill**—A drill forming part of the training of a soldier. It comes under the head of gymnastic training. It is ordered to be carried out in all infantry regiments. The object of it is to make the men supple, active, and capable of bearing fatigue. The distance to be run is not to exceed 300 yards during the first fortnight. For the second fortnight the distance may be increased to 600 yards, and for the third fortnight to 900, at the end of which time the practice is to be carried on daily at 1000 yards, the men running, on alternate days, with arms and accoutrements. For further instructions, *vide* Queen's Regulations of 1873.

**Running the Gauntlet**—A punishment formerly enforced in the navy, and which was inflicted also on soldiers. As related by James, in his 'Military Dictionary,' the mode of procedure was as follows. When a soldier was sentenced *to run the gauntlet*, the regiment was paraded in two ranks, facing one another, each soldier having a switch in his hand, and as the criminal ran between the ranks, naked from the waist upwards, he was lashed by the soldiers. While he ran, the drums beat at each end of the ranks. Sometimes he ran three, five, or seven times, according to the nature of the offence. Happily, such a barbarous punishment no longer disgraces the army or navy.

**Rupee** — An Indian coin, weighing 180 grains troy, or one tolah. The standard quality is eleven-twelfths silver, one-twelfth alloy, general value about 2s. English money, but not remitted to England nowadays at this rate. Diameter of the rupee, $\frac{1}{10}$ foot, which makes it, if necessary, a standard of length. The tolah or imperial rupee is the standard of weight in India. Compared with the English weights, 32 tolahs make 1 lb. troy, or 0·823 lbs. avoirdupois.

**Ruse** (French)—A trick; a stratagem. (*Vide* Stratagem.)

**Russian Army**—One of the chief continental armies of Europe.

Early in 1870, a new bill was submitted to the emperor and the imperial council for the reorganisation of the Russian army, and by an ukase dated November 16 of the same year, it became the military law of the country.

This bill lays down, as a first principle, that the defence of the Russian territory is a sacred duty incumbent on every Russian subject without distinction of class or position. Military service is therefore obligatory, and substitutes are not admitted into the ranks of the army. All young men who have attained the age of 20 are liable to be drawn as conscripts. A drawing by lot takes place to decide who shall remain at home, after undergoing six weeks' training. These men, for 6 consecutive years, form part of the reserve. The duration of military service is fixed at 15 years, divided as follows:—

Four years under the colours;

Two on furlough;

Nine in the reserve, with the exception of the horse artillery, cavalry, and frontier guards.

The defence of the country is provided for by regular troops or land forces and national legions.

The *land forces* are composed of—

1. The active army, completed by the annual contingents;
2. The reserves, composed of time-expired soldiers, called into the ranks in time of war;
3. The Cossacks;
4. Specially organised troops.

The *national legions* are composed of all the men not included in the regular army, but capable of bearing arms, from the age of 20 inclusive up to that of 40. They are divided into two classes:—

1. Men destined to fill up the vacancies in the ranks of the army, or to complete the reserve in case of paucity of numbers;
2. Men forming the depots of the legions.

There are besides two classes of volunteers admitted into the army: young men who have completed their education in public schools, and those who have formed or still form part of the legions. The former are bound to serve in the active army for 3 or 6 months or 2 years, according to their education and proficiency. Those who have, on drawing for the conscription, been exempted from joining the colours are incorporated in the national legions, and are compelled to go through an annual course of training. Other classes of individuals may also be exempted from service in the active army, such, for instance, as fathers of families; but they are liable to be called out in case of an insufficient supply of conscripts.

Russia has a male population of 36 millions, and the number of young men who annually attain the age for being drawn in the conscription is set down at 600,000. Estimating the mortality of the men under 4 per cent., and those not on active duty at 2 per cent., the defensive forces of Russia have been computed as follows:—

| AGE. | ACTIVE ARMY. | RESERVE. | LEGIONARIES. | |
|---|---|---|---|---|
| | | | 1st Series. | 2nd Series. |
| 21 | 200,000 | .. | 200,000 | .. |
| 22 | 192,000 | .. | 196,000 | .. |
| 23 | 184,000 | .. | 192,000 | .. |
| 24 | 177,000 | .. | 188,000 | .. |
| 25 | 170,000 | .. | 184,000 | .. |
| 26 | 163,000 | .. | 180,000 | .. |
| 27 | .. | 157,000 | .. | 176,000 |
| 28 | .. | 154,000 | .. | 172,000 |
| 29 | .. | 151,000 | .. | 169,000 |
| 30 | .. | 148,000 | .. | 166,000 |
| 31 | .. | 145,000 | .. | 163,000 |
| 32 | .. | 142,000 | .. | 160,000 |
| 33 | .. | 139,000 | .. | 157,000 |
| 34 | .. | 136,000 | .. | 154,000 |
| 35 | .. | 133,000 | .. | 151,000 |
| 36 | .. | .. | .. | 275,000 |
| 37 | .. | .. | .. | 269,000 |
| 38 | .. | .. | .. | 263,000 |

Making, without counting time-expired soldiers, 5,806,000 men. The active army, it will be seen, is set down at 1,086,000 men. In time of peace, however, this number is not kept under arms, for although in special branches the duration of the service is fixed at 7 years, the infantry is generally discharged during the last 2 years of service; so that the army may really be set down at 700,000 men under the colours, and 300,000 more on furlough. As an adjunct to this army of 1,000,000 of men, the first class of legionaries comprises 1,140,000 men, all of whom may be called upon to fill up the ranks. The reserve is composed of 1,305,000 men, and by the time this part of the law comes in force, they will be all good, solid troops, having passed through the ranks of the army. The second class of legionaries, as shown in the above table, is composed of 2,275,000 men, all of whom will be trained to the use of arms when drawn by the conscription, and they will count amongst them nearly half a million of time-expired troops.

The Russian peace footing is estimated *to* have been increased by about 50,000 *men in 1875.* The troops reinforced are chiefly the cavalry and horse artillery, who have been put on a permanent war footing, and, being mostly stationed along railway lines in the western provinces, are ready for immediate action in the field.

The Russian territory is divided into 14 military districts; the country occupied by the Cossacks of the Don forms a separate district, with a special organisation.

The permanent army* is divided into 47 divisions of infantry, 7 brigades of rifles, 10 divisions of cavalry, 50 brigades of field artillery, 26 batteries of horse artillery, 5 brigades of engineers; the numerical strength of the whole active army may be put down in peace time at 33,043 officers and 735,539 men, and in time of war at 43,355 officers and 1,358,672 men.

The infantry is composed of 12 regiments of the guard, 16 regiments of grenadiers, 4 Caucasian regiments, 4 battalions of rifles of the guard, 20 of rifles of the line, 4 Caucasian and 4 Turkestan rifles, and 148 regiments of infantry, giving a total of 196 regiments of the line.

These are massed into 3 divisions of infantry of the guard, 4 of grenadiers, 40 of infantry, and 7 brigades of rifles. The division in the Russian army is the highest unit, there being no *corps d'armée* except in the guards.

Each division of infantry is composed of 2 brigades, each brigade of 2 regiments of 3 battalions each, with the exception of the 2 brigades of the 4 Caucasian divisions, which have 3 regiments. Each battalion is composed of 4 companies.

The cavalry is divided into active cavalry and reserve squadrons.

The active cavalry comprises 10 regiments of the guard, 77 of the line (including 21 of Cossacks), and 4 of Caucasian troops. The guards are composed of 4 regiments of cuirassiers, 2 of lancers, 2 of hussars, 1 of grenadiers, and 1 of Cossacks. The Russian cavalry is divided into 20 divisions, viz. 4 of the guards (3 mixed and 1 division of Cossacks), 14 of the line, and 2 of Caucasian cavalry. Each division comprises 4 regiments divided into 2 brigades: 1 of lancers, 1 of dragoons, 1 of hussars, and 1 of Cossacks; each regiment having the same number. Thus the 1st division contains the 1st hussars, the 1st lancers, &c. Each brigade of cavalry of the guard has 2 regiments; the 2nd division has 3 brigades. Each regiment has 4 squadrons, with a strength of 224 combatants.

---

* Most of the different branches of the Russian army may be said to be in a transitional state of reorganisation.

The reserve squadrons, whose duty in time of peace is to train horses and provide their regiments with them, will in time of war fill up the vacancies produced by the campaign.

The field artillery is composed as follows:—

| | | | | | | |
|---|---|---|---|---|---|---|
| Batteries of 9-prs. .. .. .. | 141 | with | 1128 | guns and | 3384 | wagons. |
| Batteries of 4-prs. .. .. .. | 94 | „ | 752 | „ „ | 1504 | „ |
| Batteries of mitrailleurs .. | 47 | „ | 376 | „ „ | 762 | „ |
| Giving a total of .. | 282 | „ | 2256 | „ „ | 5650 | „ |

Each brigade of foot artillery is composed of 6 batteries (3 batteries of 9-prs., 2 of 4-prs. and 1 of mitrailleurs).

The horse artillery of the regular army is composed of 21 batteries and 5 batteries of the guard, 2 depot and 1 instruction batteries; each battery is formed of 6 guns. The organisation of these batteries into brigades has been changed with the exception of those of the guard, which are still formed into 1 brigade. Throughout the rest of the army, 2 batteries are attached to each division of cavalry, and come under the immediate command of the divisional commander. These will, however, be soon increased to 6 batteries of the guard (1 Cossack), and 28 batteries of ordinary horse artillery (7 Cossack), of 8 guns each. There will be besides 14 Cossack batteries in reserve.

The 5 brigades of engineers comprise 1 battalion of sappers of the guard, 1 of grenadiers, and 9 of sappers and miners, total 11 battalions; 6 half-battalions of pontoon train.

There were at the time of the reorganisation of the army 3 classes of troops which did not belong to the active army: (1) the *local* or *sedentary troops* (25 battalions of garrison infantry, and 18 battalions of infantry of the line); (2) the interior service troops (71 battalions); and (3) the reserve troops (72 battalions of the line, 10 of rifles, 56 squadrons of cavalry, 6 brigades of artillery, and 4 battalions of sappers). In the military districts of Russia in Asia, the present organisation has been maintained for the local troops; but in the other districts they have been reorganised, and form now 29 regiments *of 4 companies* each of garrison infantry, and 199 battalions of depot troops. When the army is mobilised, the strength of the depot battalions is raised to 1000 men each by means of the men of the 1st class of the militia. On war breaking out, the 2nd class of the militia will be formed into 164 infantry battalions of 4 companies each and with a nominal strength of 1000 men. The duty of these battalions will be to keep up the communications and guard the rear of the army in the field and to garrison the towns.

The *Cossack troops* are divided into regiments and *sotnias* (sections of 100 men); the strength of each regiment varies according to the number of *sotnias* called out. The whole male population is obliged to serve. By an order issued in 1872, the Cossacks have been formed into a body of men perfectly organised in time of peace, easily assembled and added to the cavalry divisions in time of war. Under the new arrangements they will supply 62 regiments and 22 batteries in time of war. In peace time they have 21 regiments and 8 horse batteries under arms. The strength of the Cossacks is between 50,000 and 55,000 men, with a reserve of 30,000 more.

The supreme command of the Russian army is vested in the emperor, with a war ministry under him. This ministry is divided into *bureaux*, including a war council of permanent committees, who deal with all the technical questions appertaining to the different branches of the service.

The mode in Russia of officering the army does not differ much from that of other continental armies. The young men who decide on a military career proceed at the age of 16 to one of the military schools, whence, at the age of 19 or 20, having passed an examination, they obtain an ensigncy, and then follow the various grades without further examination. A second captaincy is reached in about 8 years' service, and then merit can gain the epaulettes of a general in a very short time.

Candidates for the staff have to pass through the Nicholas Staff Academy.

The Russian infantry is armed with the Berdan breech-loading rifle. (*Vide* Appendix C.)

**Russian Gun**—The Russian artillery may be said to be in a transition state, experiments being continually carried on, if not to change its material, to modify the present ordnance, so as to allow that branch of the army to bear comparison with that adopted or on the point of being adopted by other armies. The guns of the Russian artillery are 4-pr. and 9-pr. B.L.R. guns, for the most part of bronze. The 4-pr., of 3·3-inch calibre, fires a projectile weighing 12 lbs. The 9-pr. gun, which forms three-fifths of its actual armament, fires a shell weighing 24 lbs. with a charge of 2·69 lbs., and possesses an initial velocity of 1060 feet only.

Experiments have been made of late with steel guns of the Krupp system (500 of which are said to be ready and held in reserve), as well as with the 9-pr. modified. The improvement made in that gun, by means of casting the metal in metallic moulds and then chilling it, have enabled it to obtain an initial velocity of 1369 feet. It differs slightly from the old 9-pr., the dimensions of the chamber being made to allow the use of a charge of 7·23 lbs. of powder. The projectile is provided with 2 belts of copper in lieu of a leaden coat. In order to obtain a flatter trajectory in long ranges, a truncated shot-bottom similar to one proposed by Whitworth has been tried. The weight of the gun and that of the projectile are the same as in the old 9-pr.

**Rust**—Oxide of iron, which forms on the surface of iron from exposure to atmospheric influence or contact with acids. The following forms a good preservative against rust, and is a good composition for guns when packed in boxes for transit abroad, viz. one part white lead, seven parts tallow. (*Vide* Varnish.)

## S.

**S.A.A. Wagons**—An abbreviation for small-arm ammunition wagons, in which the reserve small-arm ammunition of an army travels. (*Vide* Reserve Ammunition.)

**Sabicu**—A wood used for artillery purposes, in the formation of certain parts of a carriage either for land or naval purposes.

**Sabot** (French)—A wooden shoe; it means also the wooden attachment to an article. In artillery, sabots are wooden bottoms attached to spherical projectiles by means of a copper rivet. The object of the sabot is to keep the shot or shell in the axis of the piece, and by its cylindrical shape to cause the projectile to glide out of the piece without bounding up and down in the bore, by which it acquires a rotatory motion, prejudicial, from its uncertain rotation, to the direction of the projectile. This uncertain rotation has reference only to shot and shell fired from smooth-bore ordnance.

**Sabre** (French = sword)—A heavy sword, slightly curved towards the point. The back of the sword is made thick, so as to give it greater force in delivering the cut or thrust. It is used in the mounted service of the army. (*Vide* Appendix F.)

**Sabretache** (German, *Säbel*, a sabre, and *Tasche*, a pocket)—Usually an oblong leather case or pocket scolloped at the bottom, with a device in the centre, and suspended from the left side of the sword belt by three slings of the same material as the belt. It is worn by all mounted officers of the army.

**Sack, To**—To pillage, to plunder.

**Saddle**—The seat on which a rider sits when on horseback. A military saddle consists of the following principal parts: 1, the tree; 2, the web; 3, girth; 4, flaps; 5, seat; 6, panel; 7, surcingle; 8, stirrups; 9, leather (stirrups).

The following form the requisites of a good saddle:—

1. It should be as light as is consistent with strength.

2. The pressure of the whole and each part should be distributed over as large a space as possible.

3. The weight should be placed upon the part of the animal best fitted to bear it.

4. The shape of the seat should be such as to allow the rider to sit well down into it, and balance himself in every position of the animal.

5. There should be no pressure on any jointed surface either of man, horse, or saddle. A military saddle, having to carry the rider's kit, is not as light as an ordinary hunting saddle.

In the mounted branch of the service, the pattern saddle is termed *universal.* In a battery of artillery there are three descriptions of saddles, viz. the universal, driver's, and luggage. The weight of the universal saddle is 28 lbs. 2¼ oz. complete.

Besides the above, there are saddles in use in the service, termed *pack saddles*, which are carried on the backs of horses, mules, or ponies. They are suitable for the transport of mountain artillery, with its ammunition, or for any military stores, which in mountainous countries can only be carried by beasts of burden. The weight of the pack saddle is 27 lbs., and is known in the service as *saddle pack, general service.*

In pontooning, a *saddle* forms part of the superstructure of a pontoon. It consists of a frame of timber placed centrally over the axis of the pontoon, and secured to it by lashings.

**Safe-conduct**—In war time and under the circumstances of an enemy being shut up in a fortress, from which there is no egress, a safe-conduct is a pass or permission granted by the general of the besieging force to any individual in authority in the besieged fortress to proceed unmolested to the enemy's head-quarters, should he desire to hold communication on any subject of importance.

**Safety Valve**—Is described as "that important part of a steam-engine without which it could not exist. It consists of a small cover or stopper, sitting loosely on or in a small aperture in the boiler, but kept down by a certain weight made to increase its effect by a lever, so that it may, by being slid along it, like the weight on a steelyard, serve without change of weights to vary the pressure which the steam is allowed to acquire. This of course it cannot exceed without lifting the valve and escaping, until reduced below the limit thus allowed it. The valve is simply the weakest or most yielding part of the boiler, and by taking care that it shall always be the weakest, the danger of explosion is avoided. The safety valve is the invention of a Frenchman, Dr. Papin."

**St. Andrew or the Thistle, Order of**—A Scottish military order of knighthood, instituted by James VII. of Scotland (II. of England) in 1687. It fell in abeyance during the reign of William and Mary, but was revived by Queen Anne, December 31, 1703.

The star consists of a St. Andrew's cross of silver, in the centre of which is a thistle of gold upon a field of green, surrounded by a circle of green, bearing the motto of the order in gold characters. It is worn on the left side, and the ribbon to which the jewel is attached is dark green, worn over the left shoulder and tied under the arm. By a statute passed in May 1827, the order consists of the sovereign and sixteen knights, who place the letters K.T. after their names. The motto of the order is that of Scotland, "Nemo me impune lacessit."

**St. Michael and St. George, Order of**—An English military and civil order of knighthood, established in 1818 by George III. It is generally conferred for services in the colonies; K.C.M.G. are the initials indicating the knighthood.

**St. Patrick, Order of**—The national order of knighthood for Ireland, established by George III. in 1783, and enlarged in 1833. It consists of the sovereign, a grand-master, and twenty-two knights.

The star is worn on the left side; it is surrounded by rays of silver. Within this is a band of sky-blue enamel charged with the motto of the order, "Quis separabit. MDCCLXXXIII." in gold letters. The collar is of gold, and composed of roses alternating with harps, tied together with a knot of gold; the badge or jewel is of gold, and similar to the cross, with this difference, that it is oval and surrounded by a wreath of shamrocks. The ribbon is sky blue, and worn over the right shoulder. The order is indicated by the initial K.P.

**St. Petersburg, Convention of**—A convention signed in December 1868 in that city, by all the European powers except Bavaria, and the United States of America, for interdicting the use of explosive bullets in time of war.

**Saji Muttee**—An Indian term for carbonate of soda. It is found in many parts of India on the surface of the soil as a carbonate or sulphate of soda, in the proportion of 50 per cent. of the former to 10 or 15 of the latter. By washing, heating, and evaporation, the sulphate is converted into a sulphuret of sodium, which, by further heating and exposure to the atmosphere, is changed into carbonate of soda. In its crude state it is commonly used in India in clearing off the old coat of paint from gun-carriages previous to applying the new one, and for removing grease, &c.

**Salade**—In ancient armour, a kind of bascinet, but projecting much behind the head, and having a movable visor. It was introduced in the reign of Henry VI. It is also written *sallet.*

**Sal-ammoniac**—A compound of ammonia and hydrochloric acid ($NH_4CL$), and known as *muriate of ammonia.* Since the establishment of gasworks, it has been chiefly derived from the liquor obtained during the preparation of coal gas. It is translucent and colourless, and is used in tinning to prevent the oxidation of the surface of the copper.

**Saleetah**—An Indian term for a bag containing a soldier's bedding, &c. on the march. Saleetahs are also used in packing the component parts of tents. They are made of gunny cloth.

**Salient Angle**, *vide* Angle, Salient.

**Salient Order of Battle**—An order of battle, the front of the army being formed on a salient or outward angle. This formation is seldom resorted to, as it presents many disadvantages. Certain attacks of necessity assume the salient form, not to await the enemy, but for immediate attack, provision being made, by reinforcing the head of the attack, for insuring and following up its successes, and by feints carried on elsewhere to weaken the resistance. On the defensive, the salient order can be resorted to, without entailing a defeat, if the wings can be strongly protected by obstacles, and the open of the triangle placed in such a manner as to deprive the cross-fire of the enemy's artillery of its full effect.

Masses of cavalry may operate, however, with great effect from the apex of a salient order.

**Sally-port**—A passage, in old fortifications, from the body of the place towards the country through which "sallies" were made, which obtained for them the name of sally-ports. The postern is sometimes called a *sally-port.*

**Saltpetre**—Chemically called nitrate of potassa ($KO.NO^5$). This salt occurs in nature as an incrustation upon the surface of the earth in hot climates, such as in India, Arabia, and South America. In Bengal it is found in great abundance, especially in the districts of Tirhoot, Behar, and Agra. Wherever saltpetre exists, the ground is found impregnated with saline matter and perfectly barren. During the periodical rains, these districts are overflowed, the various salts are dissolved and brought into contact, when new combinations follow, and fresh salts result, as the water evaporates or percolates the soil. These are found and collected, and after repeated washings, evaporations, &c. the nitre passes into the market, where it undergoes crystallisation, and is in this state exported to Europe. The crude mass is called in Hindustani *dhoah*, and when transformed into crystals and well washed, *calmee*, and valued at 94 per cent. of pure nitre, which, however, is very much over-estimated. Saltpetre, before it is made use of as an ingredient for gunpowder, has to be thoroughly refined, so as to free it from all its impurities, which consist of extraneous salts, such as muriates, sulphates, &c., and this process is performed by boiling the crude saltpetre in large copper pans, for six or eight hours, removing, on its becoming heated, all the scum that floats on the surface. It is then pumped off and received into filtering bags, and the liquid, after passing through these bags, is conveyed by a copper pipe or channel into the refining room, where large cisterns, lined with copper, are ready to receive it. Immediately on the liquid falling into the cisterns, it is agitated with wooden rakes, until fine crystals of saltpetre form, which are raked up and placed on a sloping frame, where they remain till sufficiently drained; after this the saltpetre is thrown into a washing cistern, which has a false bottom, and thoroughly saturated with filtered water, and subsequently with distilled water—in the former case for a couple of hours, in the latter for four-and-twenty—when it is drawn off, and the saltpetre thrown into a drying bin, which has also a false bottom. It is afterwards dried either by solar or artificial means, and packed away in barrels. The proportion of *grough saltpetre* (the usual name given to coarse and unrefined saltpetre) to water is about 1¼ lb. of the former to 1 lb. of the latter. A charge of saltpetre is about 40 cwt., mixed with 270 gallons of water.

The following method of extracting saltpetre from damaged gunpowder may be found useful to officers in the ordnance department, who have not, in all probability, in arsenals in India, the appliances of a gunpowder factory for carrying out the operation with the nicety required:—

"A half-hogshead barrel must be prepared to stand over a common copper cooling pan; holes must be drilled in the bottom, and a stratum of fine sand, one foot deep, filled in; over this is to be placed a false bottom, also pierced with holes. Four times the weight of powder of pure well-water must now be added to the damaged powder, and well worked together in a separate half-hogshead. This mixture must be transferred to the filter by degrees, whence it will soon run in a clear stream. The water must then be emptied into a magazine boiler, and over a fire, in a safe corner, be thickened down by evaporation to one-half its quantity, when it will be found that crystals of pure saltpetre will form on any bit of common earthenware on which it is dropped. This being the case, the liquor may be poured into a second cooling pan, and allowed to remain twenty-four hours, when a fine crop of clean crystals will be obtained. The drawn-off water may be again reduced over the fire, and again placed to cool, and the operation continued until no water remains. Should the crystals be discoloured, they may be re-boiled with a very small quantity of clear spring water.

"By this operation over 50 lbs. of pure saltpetre may be recovered at the expense of a little firewood, from every 100 lbs. of damaged powder; and each magazine can thus supply itself with this necessary article."

**Salute**—A mark of respect performed in different ways according to circumstances.

An *artillery salute* consists of firing a certain number of guns, having reference to the rank of the person to be saluted, or the occasion on which the salute is fired.

All *royal salutes* consist of twenty-one guns, and are fired at home and abroad on days appointed for the celebration of anniversaries, such as the birth, the accession, the coronation of the reigning sovereign, and all other royal occasions.

The following are the number of guns fired as salutes in compliment to authorities, civil and military, British and foreign:—

| | |
|---|---|
| Lord-lieutenant of Ireland within his vice-royalty .. | 21 guns. |
| Viceroy of India .. .. | 21 „ |

*Diplomatic Authorities.*

| | |
|---|---|
| Ambassadors extraordinary and plenipotentiary .. | 19 guns. |
| Envoys extraordinary and ministers plenipotentiary, and envoys, ministers, and others accredited to sovereigns, with the exception of such ministers as are | |

| | |
|---|---|
| accredited in the specific character of "minister resident" | 15 guns. |
| Ministers resident, diplomatic authorities below the rank of envoy extraordinary and minister plenipotentiary, and above that of chargé d'affaires | 13 „ |
| Chargés d'affaires, or subordinate diplomatic agents left in charge of missions | 11 „ |
| Consuls-general | 9 „ |
| Consuls | 7 „ |

*Officers of the Army and Navy.*

| | |
|---|---|
| The lord high admiral, or the lords commissioners for executing the office of lord high admiral, or the commander-in-chief, or the officer commanding-in-chief, the army of the United Kingdom | 19 guns. |
| The first lord commissioner of the Admiralty | 15 „ |
| Field-marshals or admirals of the fleet | 17 „ |
| Commander-in-chief in India | 17 „ |
| Admirals or generals | 15 „ |
| Lieutenant-generals or vice-admirals | 13 „ |
| Rear-admirals or major-generals | 11 „ |
| Brigadier-generals or commodores | 9 „ |
| Return salutes to captains of the navy and officers of inferior rank | 7 „ |

In India the following officers (civil and military) are entitled to be saluted:—

| | |
|---|---|
| Members of the council of India while in office | 15 guns. |
| Provincial commanders-in-chief | 13 „ |
| Agents to the governors-general | 13 „ |
| Residents at native courts | 13 „ |
| Chief commissioners of provinces | 13 „ |
| Political agents | 11 „ |

Feux de joie (*q. v.*) are also fired as *salutes* on certain occasions.

*It is laid down* that no artillery salute *shall be fired* before 8 A.M., nor after sunset, nor during the usual hours for divine service on Sundays. In firing salutes 10 seconds is to be allowed between each round. Should the number of guns available be so few as to render such quick firing unsafe, the officer in command may use his discretion as to the time to be observed in firing the salute.

A *general salute* is given by a body of troops drawn up on parade to a general officer. The mode of performing this salute is by the whole regiment or body of troops presenting arms, the officers lowering their swords, the colours being unfurled, the drums beating, and the band playing. Should the officer saluted be the sovereign or a member of the royal family, the bands play the national anthem, and the colours are lowered.

A *salute* is made by an inferior meeting or passing his superior, when in uniform and even out of uniform, by raising his hand to his cap or chaco. The following instructions on the subject have lately been approved by the marshal commanding in chief:—

"With a view of establishing one uniform system of saluting throughout the army, the Duke of Cambridge has approved the following rules being observed in future, and noted in the Field Exercise of 1874:—1. When a soldier at the halt salutes an officer at the halt, he will make a pause of slow time between the first and second motions of the salute. 2. When a soldier passes an officer, he will salute on the fourth pace before reaching him, and will lower the hand on the fourth pace after passing him. 3. When an officer passes a soldier who is at the halt, the soldier will salute when the officer is four paces from him, and will lower the hand after a pause of six paces in quick time."

**Salvo**—Any number of guns fired together at the same moment; simultaneous discharge of artillery. This mode of firing is very effective in breaching; the concussion of a number of shot producing considerable destruction either on masonry or earthworks. Moreover, such mode of firing affects the spirits of the besieged.

**Sand** — Very fine silicious matter. There are three kinds of sand, viz. pit sand, river sand, and sea sand. Sand for moulding purposes, such as is used in casting, is properly a yellow pit-earth.

**Sandarac**—A resin, softer and less brilliant than shell-lac, but much lighter in colour; it is used for making a pale varnish for light-coloured woods, and other works for which the dark colour of shell-lac would be unsuitable. This resin is generally dissolved in spirits of wine, and with lac varnish constitutes the basis of what are called *spirit varnishes.*

**Sandbag Revetments,** *vide* Revetments.

**Sandbags,** *vide* Bags, Sand.

**Sandcrack**—A complaint common to horses, caused sometimes in a dry country by treading for any length of time upon ground from which all moisture is absent, which, by rendering the horn hard and dry, causes the hoof to be brittle and gives rise to sandcrack. In India it is not at all an uncommon complaint. Linseed meal poultices, and covering the sole with cow-dung, are not bad remedies.

**Sandhurst, Royal Military College**—A college for cadets for the infantry and cavalry, situated in the county of Hampshire, on the borders of Surrey, and about 30 miles distant from London. The "cadets' college" was originally situated at Great Marlow, but was removed to the present building in the year 1812.

On the abolition of purchase in the army, the system that hitherto prevailed, of sending candidates direct to Sandhurst, to study as cadets for their commissions, was abolished. Since then every young man desirous of entering into the infantry or cavalry branches of the service has to pass before the Civil Service Commissioners a successful competitive examination; he is then sent to the Royal Military College, where he enters as an officer with the rank of a sub-lieutenant on the half-pay list, and is gazetted, if qualified, to a regiment on completion of a course of studies in all subjects relating to military knowledge. This course lasts one year. (*Vide* Cadet.)

The establishment is placed under a military governor with an assistant. The military branch consists of a chaplain, a paymaster, a *quartermaster, a control* officer, two surgeons, and a riding-master. There are three professors attached to the educational branch, besides twenty instructors, in fortification, military surveying, drill, &c. (*Vide* Appendix A.)

**Sand-shot**—In artillery, balls of iron cast in sand (whence their name), instead of in iron moulds; this nature of shot varies in weight from 4 lbs. to 1½ oz. They are used in making up case and grape shot, and also Shrapnel for rifled guns.

**Sap**—A trench formed by sappers, in making approaches under the fire of the besieged, the working party protecting themselves by filling gabions and placing them as fast as possible along the intended line of parapet. When the fire of the enemy is slack, so that many gabions may be placed and filled at the same time, it is called a *flying sap.*

An ordinary sap is constructed by men of the royal engineers; a flying sap by infantry men. As explained in the 'R. M. A. Instruction Book on Fortification,' &c.:—

"There are three kinds of sap (properly so called), *single, double,* and *half-double.*

"*Single sap* is employed for constructing trenches, the reverse sides of which are not exposed. There are two methods of executing it, *kneeling* and *standing sap.*

"*Double sap* is used for constructing trenches when 100 yards of zigzag do not carry the approaches 32 yards to the front, or when the reverse sides are exposed to musketry fire. It has a parapet on each side, and is crossed by traverses at frequent intervals to defilade it from the work on which it is advancing. It may be executed either by standing or kneeling sap.

"*Half-double sap.*—This sap can be used instead of a double sap when the reverse side is exposed only to an oblique fire, as in forming the lodgments along the crest of the glacis of a ravelin. The trench formed by this sap is protected from both enfilade and reverse fire."

**Sappers and Miners**—A body of men now known in the British army as the royal engineers; but the rank and file still colloquially retain the name of sappers. (*Vide* Engineers.)

**Sapping**—A mode of making trenches by continually advancing the head of the trench when the execution of common trench work or flying sap would expose the workmen to a close fire of musketry before they could obtain cover.

**Sap-roller**—A hollow cylinder formed of two concentric gabions, the interval between being stuffed with strong fascines and with rods 1½ to 2 inches in diameter.

Sap-rollers are used to cover the heads of saps, and are usually made 7 feet long, the diameter of the outer cylinder being 4 feet, and of the inner one 2 feet 6 inches. A finished 7-foot sap-roller weighs, when new, 14 cwt.

**Sap-shield**—A steel plate mounted on wheels for the purpose of giving cover to the sapper in a single sap, should the earth thrown up by him not be of sufficient thickness to give him shelter. The shield used in the service is that invented by Sergeant-Major Knight, R.E.

**Sardinian Huts**—Wooden huts made by many English officers in the Crimea and by the Sardinians for their men. They were 14 feet 3 inches long and 7 feet 1 inch wide in the clear; they could contain 6 infantry soldiers, and were found very comfortable.

**Sash**—Part of the dress of an officer and non-commissioned officer. It is worn across the shoulder by officers and sergeants of the infantry; it is made of crimson silk for the former, and of a mixture of crimson and white cotton for the latter.

Sashes were formerly worn round the waist, and were originally invented for the convenience and ease of wounded officers, as they might by such means be carried off the field with the assistance of two men.

In full dress the silk sash is replaced by a narrow one made of gold and crimson silk.

**Satringee**, *vide* Dhurree.

**Saturation**—In chemistry, the solution of one body in another until the receiving body can contain no more. A solution is said to be saturated with an acid or an alkali when the latter is added in sufficient quantity to render it neutral, and supersaturated when the point of neutrality has been exceeded.

**Saucisson** (French = sausage)—A long tube of linen, filled with gunpowder and laid in a wooden case or bamboo (in India) to protect it from being trodden upon or misplaced. It is used for exploding fougasses or mines. This name is also given to an extra large fascine.

**Saul** (*Vatica robusta*)—A tree well-known in India, especially in the North-West Provinces. It is used in the construction of parts of gun carriages. The wood is strong, tough, coarse-grained, and fibrous, not easily worked, and when dressed has a hard horny surface, and the fibres appear to be interlaced with each other. A cubic foot of unseasoned wood weighs from 68 to 72 lbs. This tree grows also in Assam and Burmah.

**Savings-banks**—Government institutions established by act of parliament with a view to encourage habits of economy. They have been introduced into the army. By means of such banks the soldier can profitably deposit his money under government security to the extent annually of £30, the whole deposit being confined to £200, inclusive of interest. Interest at the rate of £3 15s. per cent. per annum is paid; no interest is allowed on other parts of a pound than 6s. 8d. and 13s. 4d., nor on sums that have not remained in deposit one month.

**Saw**—A tool used in working timber. It usually consists of a long strip of thin steel with one edge cut into a continuous series of sharp teeth. This nature of tool admits of great variation adapted to different purposes. The principal saws are described as follows:—

"*Bow saw*, or *frame saw*, also called the *turning saw* or *sweep saw*.—Used for the general purposes of carpentry. In using the bow saw, the work is mostly fixed vertically, and therefore the blade is used horizontally; but the frame is placed at all angles, to avoid the margin of the work, and it is frequently necessary to twist the handles or pins during the cut to modify the position of the frame."

"*Circular saw*.—A saw which has come into universal use within the present century, wherever machinery can be had for working it. It is generally so fitted as to be worked under a flat bench, a part only of the blade projecting through a narrow slit cut in the top of the bench. It is made to revolve with great rapidity, which depends on the power which moves it, and the wood resting on the bench is pushed against the saw in the direction it is intended to be cut."

"*Compass saw.*—Resembles the hand saw in its general structure and in the form of its teeth, to allow them to be as a tangent to the curve."

"*Endless saw-band.*—An instrument for a swing material of an irregular form. There are two kinds, one for cutting wood and another for cutting iron. By the latter, iron 1 inch thick can be cut into any curved form at the rate of 1½ inch per minute. This saw is extensively used for cutting the brackets, transoms, and all irregular forms required in the manufacture of wrought-iron carriages."

"*Hand saw.*—This nature of saw is used for ordinary purposes, such as preparing woods for the work required after they have been cut at the saw-pit into planks and boards. The hand saw is made taper in order that the blade may possess a nearly equal degree of stiffness throughout the greater width; it also facilitates the attachment of the handle. Were the blade as wide at the point as at the handle or heel, it would add useless weight to the saw, which, from the weight at the far end, would be more flexible at the handle than at the point."

"*Tenon saw.*—A smaller nature of saw than the hand-saw. It tapers, and has a back to it of stout sheet iron or truss folded together. It is used for fine and accurate work and for such work as its name denotes. It has about 8 teeth to the inch."

**Saw-setter**—An instrument for bending the teeth of the saw. It consists of a narrow blade of steel with notches of various widths for different saws. In using the saw-setter, the saw is allowed to remain in the clamps after having been filed, and the alternate teeth are inserted a little way in that notch which fits the blade most exactly, and they are bent over by applying a small force to the handle, which is either raised up or depressed equally for each tooth.

**Scabbard**—The sheath of a sword or bayonet; it is made either of metal or of leather, in the latter case tipped and surmounted with metal. In the infantry, the scabbards of general and field officers are made of brass. In the cavalry and artillery, officers of all ranks, as well as men, wear steel scabbards; staff officers, either brass or steel, according to their rank and position. (*Vide* Appendix F.)

**Scale** (Italian, *scala*, a ladder)—In mensuration, a line or rule of a definite length divided into a given number of equal parts, and used for the purpose of measuring other linear magnitudes. In map or plan drawing, the scale expresses the relation which the dimensions of the map bear to the natural features of the ground; this relation is frequently expressed by a representative fraction. For example, the representative fraction of a map on a scale of 1 inch to a mile is $\frac{1}{63360}$, that is, 1 inch on the map is equal to 63,360 inches (1 mile) on the ground; in other words, the map represents all features on the ground 63,360 times smaller than their natural size.

The following is the rule given for finding the fraction of a given scale.

Reduce the number of yards in a mile into inches; divide the number found by the number of inches on which the scale is made, and the dividend will be the number of inches represented by one mile.

*Ex.*—To find the representative fraction of a scale six inches to a mile.

6 inches = 1 mile or 1760 yards or 63360 inches.

$$\therefore \frac{63360}{6} = 10560.$$

Therefore 1 inch = 10560 or $\frac{1}{10560}$.

Rule for finding the number of inches to a mile when the representative fraction is given.

Divide the fraction by the number of inches in a yard; the dividend will give the number of yards represented by an inch. Then divide the number of yards in a mile by the number of yards represented by 1 inch, and the result will give the number of inches to a mile.

*Ex.*—Find the number of inches to 1 mile in a scale, the representative fraction being $\frac{1}{1540}$.

$$\frac{1540}{36} = 440.$$

$$\therefore \frac{1760}{440} = 4,$$

or 4 inches to 1 mile.

All countries have adopted special scales for their various classes of maps and plans; the following are those in use in the English ordnance survey:—

| Natural Scale. | Inches to 1 Mile. | REMARKS. |
|---|---|---|
| $\frac{1}{500}$ | 126·720 | Plans of towns. |
| $\frac{1}{528}$ | 120 | Ditto. |
| $\frac{1}{1000}$ | 63·36 | Ditto. |
| $\frac{1}{1056}$ | 60 | Ditto. |
| $\frac{1}{1760}$ | 36 | Special maps. |
| $\frac{1}{2376}$ | 26·6 | Ditto. |
| $\frac{1}{2500}$ | 25·344 | Parish plans. Cadastral survey. |
| $\frac{1}{2640}$ | 24 | Special maps. |
| $\frac{1}{5280}$ | 12 | Ditto. |
| $\frac{1}{10560}$ | 6 | County maps. Reconnaissances. |
| $\frac{1}{12672}$ | 5 | Indexes. |
| $\frac{1}{15830}$ | 4 | Special maps. |
| $\frac{1}{21120}$ | 3 | Indexes. Reconnaissances of roads. |
| $\frac{1}{31680}$ | 2 | Special maps. |
| $\frac{1}{63360}$ | 1 | General map of the United Kingdom. |
| $\frac{1}{253440}$ | 0·25 | Special maps (4 miles to an inch). |
| $\frac{1}{316800}$ | 0·2 | Ditto (5 miles to an inch). |
| $\frac{1}{633600}$ | 0·1 | Index map (10 miles to an inch). |
| $\frac{1}{1900800}$ | 0·03 | Special maps (30 miles to an inch). |

The best scales for field surveys are 2, 4, and 8 inches to a mile; for an index plan, 2 and 3 inches to a mile.

Continental nations indicate the scale upon which a map is drawn, by the fraction that any linear distance measured thereon is of the actual distance on the ground.

The principal scales used for military maps in Europe are as follows:—

| | |
|---|---|
| Austria .. .. .. | $\frac{1}{14400}$ = 4·4 inches to the mile. |
| | $\frac{1}{28800}$ = 2·2 ,, ,, |
| | $\frac{1}{86400}$ = 0·733 inch ,, |
| Belgium .. .. .. | $\frac{1}{20000}$ = 3·168 inches ,, |
| | $\frac{1}{40000}$ = 1·584 inch ,, |
| | $\frac{1}{80000}$ = 0·792 ,, ,, |
| Denmark .. .. .. | $\frac{1}{20000}$ and $\frac{1}{80000}$. |
| | $\frac{1}{160000}$ = 0·396 ,, ,, |
| France .. .. .. | $\frac{1}{80000}$ and $\frac{1}{40000}$. |
| | $\frac{1}{320000}$ = 0·198 ,, ,, |
| Germany .. .. .. | $\frac{1}{25000}$ = 2·534 inches ,, |
| | $\frac{1}{50000}$ = 1·268 inch ,, |
| | $\frac{1}{100000}$ = 0·634 ,, ,, |
| | $\frac{1}{80000}$ and $\frac{1}{200000}$. |
| Holland .. .. .. | $\frac{1}{25000}$ and $\frac{1}{50000}$. |
| *Italy..* .. .. .. | $\frac{1}{86400}$ and $\frac{1}{50000}$ and $\frac{1}{25000}$. |

| | |
|---|---|
| Russia .. .. .. | $\frac{1}{84000}$ = 0·754 inch to the mile. |
| | $\frac{1}{126000}$ = 0·508 „ „ |
| Spain .. .. .. | $\frac{1}{60000}$ = 1·056 „ „ |
| | $\frac{1}{100000}$. |
| Sweden and Norway .. | $\frac{1}{20000}$ and $\frac{1}{100000}$ and $\frac{1}{200000}$. |
| Switzerland .. .. | $\frac{1}{25000}$ and $\frac{1}{50000}$. |

By dividing 63,360 (number of inches in a mile) by the denominator of the fraction of the scale, the number of inches it is to the English mile will be found. Thus—

$$\frac{63360}{86400} = 0·733,$$

or the scale of $\frac{1}{86400}$ is equal to

0·733 inch to the mile.

A *scale of shade*, the invention of Colonel Scott, R.E., has been introduced into the service, and is used as a guide in determining the thickness and distance apart of each hachure for different angles and slopes. This scale is engraved for convenience on the back of a protractor, and is graduated for 35°, 25°, 15°, 10°, 7°, 5°, 3°, and 2°.

The term *scale* is also applied to a mathematical instrument consisting of an assemblage of lines engraved on a rule of wood or ivory, by means of which certain proportional dimensions or proportions are obtained by means of compasses. The principal are the *plain scale*, the *diagonal scale*, and *Gunter's scale.*

The *diagonal scale* is a mathematical instrument which is used when minute parts of a measurement are required, such as the tenth or hundredth part of an inch. The formation of this scale is thus described in Heather, on 'Mathematical Instruments':—"Draw eleven parallel equidistant lines; divide the upper of these lines into equal parts of the intended length of the primary divisions; and through each of these divisions draw perpendicular lines, cutting all the eleven parallels, and number them 1, 2, 3, &c., commencing from the second. Subdivide the first of these primary divisions into ten equal parts, both upon the highest and lowest line of the eleven parallel lines, and let these subdivisions be reckoned in the opposite direction to the primary divisions, as in the simply divided scales. Draw the diagonal lines from the tenth subdivision below to the ninth above, and so on, until a line from the first below joins the zero point above. Then, since these diagonal lines are all parallel and equidistant, the distance between any two of them in succession, measured upon any of the eleven parallel lines which they intersect, is the same as this distance measured upon the highest or lowest of these lines, that is, as one of the subdivisions; but the distance between the perpendicular, which passes through the zero point, and the diagonal through the same point, being nothing on the highest line, and equal to one of the subdivisions on the lowest, is equal to one-tenth of a subdivision on the second line, two-tenths on the third, and so on; so that this, and consequently each of the other diagonal lines, as it reaches each successive parallel, separates further from the perpendicular through the zero point by one-tenth of a subdivision, or one-hundredth of a primary division."

*Gunter's scale* is a flat brass rule, usually 2 feet in length, and about 1½ inch broad, having on one side equal parts, rhombs, cords, &c., as on the other plane scale, and on the other, the logarithms of these numbers; hence the lines on this side are called the logarithmic lines.

The term *scale* is also given to a graduated steel or wooden bar attached to guns, and known as the *tangent scale.*

The *tangent scale* attached to S.B. ordnance is a rod of metal or wood, made to slide perpendicularly in a groove at the breech, having engraved upon it the actual lengths of the tangents to the different angles of elevation.

The object of the tangent scale is to give elevation to a piece of ordnance beyond what the line of metal affords.

In rifled guns the tangent scales, of which there are two attached to each gun, do not rise in a vertical plane, as in smooth-bore ordnance, but are set at an angle to the left from the vertical, to compensate for the lateral deviation caused by the right-handed rifling. They each consist of a rectangular steel bar, on which is engraved all information for the successful discharge and laying of the gun, such as the range, length of fuze, nature of charge, &c. On the top of the scale a tangent sight is attached, which has a cross-head with sliding leaf and clamping screw, by means of which the deflection caused by the wind blowing across the range, or one wheel being higher than another, can be met. This is known as the *deflection scale.* This scale is graduated to 30′ on each side of the cross head, each 30′ being divided into three spaces of 10′ each. By the aid of this scale, as shown above, compensation can be made to the right or left for the deflection of the shot by wind or inequality of the ground on which the carriage may be standing.

This scale must not be mistaken for the scale for *permanent deflection* caused by the rifling of the gun. This deflection is met by the position of the tangent scale or sight. (*Vide* Sights.)

**Scale, Beam,** *vide* Beam Scale.

**Scale, To**—To climb. (*Vide* Escalade.)

**Scales**—Ancient armour made of thin brass, laid like fish scales one over the other, for the protection of any part of the body, chiefly for the shoulders and the head. It is still used in the East and by Circassian soldiers.

**Scales, Marquoise,** *vide* Marquoise Scales.

**Scalet**—An ancient name given to a lifting-jack. It was chiefly used in extricating wheels from deep ruts and soft ground.

**Scaling**—In artillery, firing a small charge of powder from M.L. ordnance, before commencing practice, for the purpose of clearing the piece from any dirt or deposit which may be lying in the bore.

**Scaling Ladders,** *vide* Ladders.

**Scantling**—The transverse dimensions of a piece of timber in breadth and thickness. It is also the name given to *quartering* for a partition, &c. All quartering under 5 inches is termed " scantling."

**Scarfing**—The junction of two pieces of timber by being bolted or nailed transversely together, so that the two appear as one. Scarfing is also applied in ironwork.

**Scarp,** *vide* Escarp.

**Schoolmaster, Army**—A non-commissioned officer of the first class, ranking next to a sergeant-major. His duty is to teach the soldiers and their children the rudiments of general knowledge, to examine the girls' schools, and to deliver lectures to soldiers. There are in the British army 5 first-class schoolmasters, receiving 7s. 9d. per diem; 5 second-class, 6s. 9d. per diem, and 164 army schoolmasters, whose pay varies from 3s. 9d. to 6s. 9d. a day. Schoolmasters for the army are trained at the Duke of York's School, Chelsea.

By the 139th Article of War, an army scoolmaster may be sentenced to dismissal or loss of service, but not to reduction.

**Schoolmistress, Army**—A person attached to each regiment or corps for the purpose of instructing the daughters of soldiers and their sons under 8 years of age in the rudiments of English and in plain needlework. There are three classes, first, second, and third class schoolmistresses, of which there are 14 of the first class, receiving from £44 to £50 per annum; 48 of the second class, at £36 per annum, and 122 of the third class, at £30 per annum.

These and the schoolmasters are assisted in their duties by acting schoolmistresses and schoolmasters, pupil teachers and monitresses.

**Schools, Military**—Establishments for the education of officers, non-commissioned officers, and men of the army. These schools are either *regimental* or *special*, and are placed under the supervision of the director-general of military education, assisted by military inspectors of schools. (*Vide* Education, Military.)

*Regimental schools* are attached to each regiment, battalion, corps, or garrison, under a schoolmaster (*q. v.*), for the purpose of affording to non-commissioned officers, soldiers, and their children, boys and girls, the opportunity of acquiring a sound and useful education. Every encouragement is given to enable them to attend these schools, and commanding officers can require married soldiers to send their children to these institutions on pain of forfeiting certain privileges. In addition to the schools where adults and more advanced children are taught, an infant and industrial school, under a schoolmistress (*q. v.*), is established in every corps.

Adult soldiers are admitted gratuitously; for children there is a nominal charge of 1d. each a month. Children of soldiers serving abroad and orphans of soldiers are received without payment; those of pensioners, &c. at 3d. a month, and the children of officers at 5s. a month.

There are also in some of the large garrisons, such as at Aldershot, *officers' children's schools*, under a board of management, composed of a president and two members, appointed by the general commanding, and superintended by a lady principal. Officers and others employed by government having a relative military rank can send their children at a charge of from 15s. to 7s. 6d. a month, according to the age of the child and the rank of the father.

*Special schools* are establishments for the preparation of candidates for the army, and for the instruction of officers and men in the special duties of the different branches of the service. The former are the Royal Academy (*q. v.*) at Woolwich, for artillery and engineers; the College of Sandhurst (*q. v.*), for infantry and cavalry; and the Greenwich Royal Naval College (*q. v.*), for officers of the marine artillery and infantry. The latter comprise the following:—

*Schools of instruction.*—Establishments for the education of officers of the regular army and of the auxiliary forces in the advanced branches of their profession. To give officers an opportunity of going through the course carried on at these schools, they are detached in turn from their regiments. Schools have been established in all the large garrison towns of the United Kingdom, and specially for the auxiliary forces, at Glasgow, London, Manchester, and Dublin, where they are placed under garrison instructors. In India, similar means of instruction are given to officers, and for this purpose garrison instructors are appointed to each of the principal cantonments or districts.

*School of Gunnery.* — Established at Shoeburyness for the purpose of giving practical instruction to officers and men of the artillery, and for carrying out experiments connected with their branch of the service. This school consists of a commandant and a brigade-major, with 6 instructors in gunnery and 2 superintendents of experiments. Officers, non-commissioned officers, as well as squads of men, selected from brigades of artillery, are sent thither from Woolwich for instruction in gunnery and the use of military machines, &c. The course of instruction at this establishment is divided into a *long* and *short* course.

The *long course* is an annual course of instruction for officers and non-commissioned officers of the royal artillery, partly carried out at Woolwich, and partly at Shoeburyness. One officer is selected from every brigade at home and abroad, and 2 or 3 non-commissioned officers from a home brigade; they assemble at Woolwich on February 1, and go first through the manufacturing departments of the Woolwich Arsenal for 2 months. They then go to Shoeburyness, and remain there 9 months, during which time they complete a course of gunnery, signalling, bridging, &c. At the end of this period, they have to be examined, and certificates are given according to their qualifications. Officers obtaining a first-class certificate are eligible for the appointment of instructors, and non commissioned officers for that of assistant instructors.

The *short course* is a similar course, but only lasts 2, 3, or 4 months, and is formed as circumstances allow, but at no specified time. It is usually composed of 2 or 3 non-commissioned officers from each or several home brigades. This course is usually confined to gun exercises and the uses of the various kinds of ammunition.

*School of Military Engineering.*—Formed at Chatham for the special training of officers of the royal engineers, after they have passed through the academy at Woolwich, also for the men and recruits of the corps. This school consists of a commandant, a brigade-major, 2 discipline officer, and 11 officer instructors in construction, surveying, field fortification, telegraphy, &c.

Officers of the cavalry and infantry are permitted to attend the classes of instruction given at Chatham in flag-signalling, surveying, &c.*

A branch of this school has been established on board her Majesty's ship *Hood*, in the Medway, for the training of engineers in submarine or torpedo duties. The men forming the torpedo companies are selected, on the completion of their course of instruction in fieldworks, from the depot companies of the School of Military Engineering, where, later on, extensive and practical knowledge of electricity in its application to the ignition of mines is imparted to them.

*School of Musketry.* — Established at Hythe, in 1854, with the view of giving a special training in the theory and practice of musketry to officers, non-commissioned officers, and soldiers, qualifying as musketry instructors for their regiments. In order to secure a uniform system of instruction throughout the army, each regiment sends officers, non-commissioned officers, and men to Hythe to receive the necessary instruction; the course lasts two months. These officers and men, on joining their regiments, are employed as instructors. With regard to the choice of officers sent to this school, it is, for the most part, voluntary; but if none send in their names, the commanding officer chooses them himself.

Officers obtain certificates at the end of the course, according to their proficiency: extra first, first, and second class. An officer, before being appointed an adjutant, has to go through the course, and must obtain, at least, a first-class certificate.

The school is composed of a commandant, an assistant deputy adjutant-general, and 5 instructors of musketry. Returns are made out yearly and published by the War Office.

*Medical School.*—An establishment at Netley for training, in military surgery and medicine, young men desirous of entering the army as surgeons. It is placed under the immediate direction of the principal medical officer of Netley Hospital, who is assisted by a staff of 9 professors and assistant professors in surgery, medicine, &c.

Attached to this school is the hospital of Netley (*q. v.*), where military nurses are trained and instructed.

*School of Music*, at Kneller Hall, near Hounslow, for the training of band-masters and musicians. Men showing musical talent and abilities, and desirous of being trained as band-masters and musicians, may offer themselves as candidates to this school on the recommendation of band committees, and are admitted into it under certain conditions.

*Duke of York's School.*—A government institution at Chelsea for the education of the male orphans of British soldiers. This school was established in 1803 by the Duke of York, and at present contains about 500 boys, who are brought up to some trade or prepared for the army. A branch of this establishment is set aside for the education of military schoolmasters.

Similar schools have been established in India. In Bengal they are situated in the Himalaya Mountains, and are known as the *Lawrence asylums*, after the founder, the late Sir Henry Lawrence; in Madras, at Ootacamund; and in Bombay, in the Mahableshwur Hills.

*Royal Hibernian Military School.*—A military school at Dublin for the maintenance, education, and training of boys for the purposes of enlistment and service in the army.

The children to be admitted into the institution must be free from mental or bodily defect or infirmity. They must be the children of a non-commissioned officer or soldier in her Majesty's regular forces, or of a non-commissioned officer or soldier deceased or discharged from the service. Children to be admitted must not be under 7 nor above 12 years of age.

In the selection of boys for admittance, preference in general is given:—

Firstly, to orphans;

Secondly, to those whose fathers have been killed or have died in foreign or home service;

Thirdly, to those who have lost their mothers, and whose fathers are absent on duty abroad;

Fourthly, to those whose fathers are

---

* *These classes* have been transferred from *Chatham to Aldershot.*

ordered abroad on foreign service, or whose parents have other children to maintain.

*Advanced Class, Woolwich.*—Though not strictly included under the head of military schools, the Advanced Class at Woolwich for the instruction of artillery officers in the higher branches of their service may advantageously find insertion here. This class was first established in 1864. It was formed for the purpose of giving artillery officers a special training in military and scientific subjects. The result of the instruction given at this institution has been all that could be desired, and the value of this advanced class appears to be appreciated from year to year. An examination is held every second year, and the course lasts for 18 months. The examination is conducted by the director-general of military education. The class is open to all royal artillery officers who have 9 years' service. Lieutenants must, before competing, have passed the examination for promotion to captain, and all officers must be favourably reported on by their commanding officers for efficiency, &c.

The class consists of 8 officers, who are instructed in mathematics, chemistry, and physics. At the end of the 18 months, there is a final examination, which is open to all students, and if the result is satisfactory, the individuals are recommended for appointments, though the fact of having passed does not constitute any claim to an appointment.

**Science**—The regular development of any branch of knowledge.

**Science of War**—The study of warfare worked out, in the first place, theoretically, and in the second, practically, or, in other words, on the drill-ground and in the field. Such study leads the soldier to the attainment of a knowledge which must sooner or later bring out his best instincts and qualifications, and in a nation the power of taking care of itself.

This science is a progressive one, and is developed by a nation in the study of what other nations have done in acquiring a knowledge of warfare, in making use of the knowledge it possesses in developing its own resources, in placing itself in a position to ward off disaster, and in succeeding in the hour of danger.

Improvements in fire-arms and all warlike munitions, and the facilities of locomotion, are continually altering the conditions of modern warfare. A system which has placed one nation at the head of others may, 30 years afterwards, be its destruction if blindly adhered to, and on this point we may learn from the study of the science of war how the preeminence and the deterioration of a nation may take place.

This subject is thus alluded to in an old French work, entitled 'Nouveau Dictionnaire Militaire':—"The science of war, or the knowledge of military tactics upon an extensive scale, is perhaps the most comprehensive operation of the human mind, and demands the full exercise of all its powers. To be equal to the multifarious branches of this unbounded art, the strictest attention must be given to military discipline. The best authors, both ancient and modern, must be resorted to for information, and when the mind has been well stocked with the sound principles of theory, practice and experience must follow, in order to confirm what has been carefully selected from the first authorities, and maturely digested. Courage, zeal, prudence, and discretion must likewise be the constant companions of those persons who would distinguish themselves in war; and it ought never to be forgotten that a scrupulous adherence to morality, a rigid observance of every social duty, and a manly subjugation of the many passions by which different men are differently agitated, must constitute the character of a real warrior. These are the qualifications by which the science of war is distinguished from every other pursuit in life; and without these qualifications, a conqueror can neither be called a hero nor an able general, but only a lucky soldier. We have, indeed, our military colleges and institutions, and so had the Grecians and Persians, not only for the instruction of the privates, but also for the education and formation of those individuals who were destined to be officers. These colleges and institutions were under the superintendence of persons who had established their reputation by a knowledge, not only of the theoretical, but also of the practical branches of their profession. Nobody could be admitted in the capacity of master or professor unless he had previously undergone several examinations respecting the science of war, both as to offensive and defensive operations. These professors were called tacticians."

**Scimitar** — A short curved sword, chiefly used by Orientals, but worn in Europe during the fourteenth century. It was borrowed from the Turks, and introduced as an offensive weapon into England in the reign of Edward II.

**Scissel** (Latin, *scissilis*, that may be rent or broken)—The clippings or leavings of metal, such as are left after the manufacture of copper caps, tubes, coinage, &c.

**Scotching**—A term used in artillery to prevent a wheel from moving, by the application of a *scotch* or wedge of wood. This is rendered necessary in mounting or dismounting ordnance from their carriages.

**Scots Greys**, *vide* Dragoons.

**Scour, To**—To clear a space; to drive away. Hence *to scour the country* means to clear the country of the enemy for miles around.

**Scouts** — Light horsemen sent on in advance of an army, or on the enemy's flanks, or again for special purposes when armies are nearly in contact. They are used for gaining information, and form a valuable branch of the intelligence department, once hostilities have commenced. They are also known under the names of "feelers," *éclaireurs* (*q. v.*). (*Vide* Light Cavalry.)

**Scrap Iron**—Receives its name from its being made up of old wrought-iron articles, such as bolts, nuts, keys, screws, horseshoes, musket-barrels, hooks, &c. which are cleaned by the process of "drumming," to clean off the rust before they are fit for use. This is one kind of scrap iron; but there is another produced from the shavings obtained in the process of turning and boring the various parts of wrought-iron guns. This nature of iron is used in solid forgings, such as the breech-pieces, trunnion-rings, cascables, &c. of guns. The first named is *the most tenacious*, and the other the most *uniform in* structure.

**Scratch Brush**—A cylindrical bundle of fine steel or brass wire tightly bound in the centre, with the ends projecting at both extremities so as to form a stiff brush for cleaning and scratching metals preparatory to gilding or silvering, or, as in the case of small-arms, preparatory to browning them. As well as the shape above described, there is another, in which the steel wire is fastened in long lengths on leather or cloth, and in this form is known as *scratch card.*

**Screen Battery**, *vide* Battery.

**Screw** — One of the six mechanical powers. It is applied in pressing or squeezing bodies together, and also in raising weights. The definition of a *screw* is given as follows:—"A spiral groove or thread winding round a cylinder, and everywhere making the same angle with the length of it; so that, if the surface of the cylinder, with this spiral thread upon it, were unfolded and stretched into a plane, the spiral thread would form a section of any inclined plane whose length would be to its height as the circumference of the cylinder is to the distance between two threads of the screw. When the spiral thread is upon the outside of the cylinder, the screw is said to be a *male* one; but if the thread be cut along the inner surface of a hollow cylinder, it is said to be a *female* screw."

**Screw, Elevating**, *vide* Elevating Screw.

**Screw-driver** — An instrument for driving a screw, also for unloosening it. Known commonly as the "turn-screw."

**Screw-jack**—An instrument for lifting heavy weights through short lifts; it rests by means of a large nut upon a hollow base or pedestal, and is raised or lowered by turning the nut.

**Screw-plate**—Is explained as "a machine for cutting small metal screws wormed and notched, but furnished with several holes varying slightly in size, the worm being formed progressively by using holes gradually diminishing in size. From 2 to 6 holes are intended for each thread, and are arranged in groups for the purpose. Although the screw-plate is sometimes used for common screws as large as from ¼ to ⅜ inch diameter, it is better to use die-stocks for all screws exceeding about $\frac{1}{16}$ inch diameter."

**Screws, Oscillating**—Elevating screws attached to heavy ordnance carriages for elevating the gun; they are used either with guns of position or siege guns.

**Searcher**—A gun implement used in examining the bores of smooth-bore ordnance.

**Seasoned Timber**—Timber which has been deprived of its sap and moisture, and thus rendered dry and hard. Before timber can be used, the juices must be got rid of from the capillary vessels, or the wood will remain moist and green for a considerable period, and the planks formed from it will be subject to dry-rot. In Europe, after the tree has been felled, barked, and roughly squared, it is thrown into either running or standing water: the former is preferred, as the constant motion of the water carries away with it the juices from the wood, and the water more readily evaporates from the wood at a future period. The length of time that timber should be seasoned depends on whether the logs are soaked in standing or running water, a longer period being necessary in the former case. After being taken out of the water, the logs should be stacked in open and airy sheds, so as to allow the timber to dry thoroughly before it is taken to the saw-pit. Various means have been devised for seasoning wood other than those described above. To season by steam is not so efficacious as the old and usual method of seasoning. The following extract from a very useful little pamphlet on the timber of Bengal, by Mr. W. Clifford, formerly attached to the gun-carriage manufactory at Madras, entitled 'Indian and Burman Timbers,' is herewith given, showing that the method of seasoning in Europe is fatal to wood in India:—

"Seasoning develops and consolidates all the good qualities of wood, and they reach their highest degree of perfection by gradual seasoning—results which can be reached in India by no other process, for experience has proved that forcing not only leads to greater loss in seasoning, but impairs the more valuable properties of the wood.

"In Europe *it is the practice,* and experience must have decided its advantage, to give timber a preparatory seasoning in log, exposed to the weather. In India it is simply worse than useless to do so. The effect of two or three years' exposure is to cover the surface with deep sun-flaws, penetrating to the depth of 1½ to 2 inches, destroying effectually much of the best portion of the log for all purposes of the carriage-builder. Long-continued exposure will render the log worthless. If kept in log, it must be protected from the sun and rain, then good may result from the measure, but not even then in proportion to the delay and consequent loss of capital which it involves; for seasoning in log is a very tedious process. It must be evident that the smaller the scantlings, and the greater the surface acted on, the quicker will be the process of drying. A piece of wood that will take years to dry in the log would dry better in as many months if cut to its required size; the ratio of drying being the same in both. A saul plank 16 inches × 1 inch will take from six to eight months to season, a scantling 4 × 4 inches will take two years and eight months, the cubic contents of each being the same. The result of exposure to saul timber is to flaw the surface to the extent the drying proceeds, to close the pores of the wood, and to prevent the free evaporation of the internal moisture; and it will be found in converting the log that it is nearly as wet inside as when first felled, so that the only gain is the absolute loss of the finest portion of the log; besides, timber, however well seasoned in log, always holds a latent proportion of moisture which is not set free till it is converted, or till the log attains a great age.

"Therefore, if timber cannot be protected from the sun, it should be converted at once, and stored to season, and the sooner this is done the less will be the loss in conversion, and the quicker will the material be fit for use.

"For this purpose the material should be cut into a half wrought state—that is to say, sufficient should be allowed over the finished dimensions to cover shrinkage, superficial flaws, warping, and end splits. A safe ratio of allowance in saul is 2 inches to the foot in length, breadth, and thickness; thus in the finished dimensions of large framings, 21 feet × 12 inches × 4½ inches, the half wrought would be 24 feet 6 inches × 14 inches × 5¼ inches, or, for such a large scantling, it would be safer to make it 5¾ inches. For sissoo and teak, the allowance may be reduced about one-third.

"The material should be stored in a good shed, well ventilated. The shed should be built at opposite angles to the prevailing winds, and be constructed so as to protect the material from the direct action of the wind from any quarter, for experience has proved that the material suffers quite as much from the dry winds playing on it as from the heat.

"Advantage would be gained by lowering the temperature of the seasoning shed during the hot months, either by underground air ducts, or by the more simple plan of a bheestie's mussuck; what is wanted is to check the too rapid evaporation of the surface moisture, which, by the unequal contraction in shrinkage, has such a ruinous effect on saul. Quick drying is not so much wanted as gradual and regular drying, for it will be found that what is gained in time is more than lost in material. It is the extremes of our Indian climate that render seasoning such a difficult and costly process.

"All woods, even when dry, absorb moisture from the atmosphere in wet weather in a greater or less degree; of the woods I have noticed, saul the most, sissoo the least. The best preservative against this is good paint."

**Seasoned Troops**—Troops which have grown accustomed to the climate of a country, and have become able-bodied soldiers.

**Seat**—In gunnery, this term is applied to the position of the shot in the bore of a piece of ordnance when rammed home.

**Seat of War**—The country in which a war is carried on.

**Sebastopol Hoop-iron Gabion,** *vide* Gabion.

**Secant** (Latin, *seco*, I cut)—In trigonometry, a line drawn from the centre of the circle through one of the extremities of the arc to meet the tangent at the other extremity. The *secant* of an angle is the reciprocal of the cosine.

**Second**—The sixtieth part of a minute whether of time or of angular magnitude. Thus, a degree of a circle and an hour of time are each divided into 60 minutes, and each minute into 60 seconds.

**Seconded** — The term is applied to officers whose services are lent by the War Office to another department or government, and who are not provided for in the estimates. The place of officers on the seconded list is filled up by regimental officers, so that the effective strength of the corps does not fall below its number. Seconded officers are permitted, on special occasions, and on being reappointed, to be absent from their corps for 10 years. At the end of that time they must return to regimental duty, or permanently retire from the army on full or half pay; if not entitled to retire, by the regulations of the service, they must resign their commissions.

**Secret Correspondence,** *vide* Messages.

**Secretary** — An officer appointed to carry on the correspondence of an office, under the orders of his superior. (*Vide* Military Secretary.)

**Secretary of State for War**—An officer appointed by the crown to administer the affairs of the army. He is assisted by the commander-in-chief, and is responsible to parliament for the efficiency of the army in men and *matériel.* He has immediate control over every branch, and has two under-secretaries of state as assistants. The Queen's Regulations define the correspondence on military subjects which should be referred to his office.

**Section** (Latin, *sectio*, from *seco*, I cut)—A cut made by a plane passing through a work in any direction.

**Sectograph**—A scale for use with a contoured map or plan, which enables the surveyor to make a section of the ground with the least possible expenditure of time and labour. The contours on the map furnish the data, and enable the surveyor to produce the required sections. It is, as stated by the designer, Lieutenant Tressider, R.E., a means of giving to a map the advantages of a model without its defects.

**Sector**—The sector of a circle is the figure contained by an arc, and the two radii drawn to the extremities of the arc. A sector is also a mathematical instrument which is used in making diagrams, laying down plans, &c.

**Sedentary Troops**—Bodies of troops that remain at home to garrison towns, fortresses, &c., after the active army and the reserve have left the country. By the new mobilisation scheme, a large force, including a few regular regiments and the garrison artillery, forms the garrison or sedentary army of the country. It is divided into 13 separate commands, and will in time of war have to watch and to defend the coasts. (*Vide* Mobilisation.)

**Seer**—An Indian weight of 2 lbs.

**Segment** (Latin, *segmentum*, a part cut off)—In geometry, any part cut off from a figure. Thus the segment of a circle is the part cut off by a chord.

**Segment Shell**, *vide* Shell.

**Seizing Line**, *vide* Line, Seizing.

**Selection**—The act of choosing and taking from among a number. In the British army, selection according to merit is the system observed in promoting officers from a lower to a higher grade.

**Sell Out, To**—The permission formerly given to an officer in the army, on retiring from the service, to sell his commission for the stipulated sum of money laid down by the regulations. Since the non-purchase system has been established, this sanction is only granted to those officers who entered the service previous to 1871, in which year the purchase of commissions was abolished. Officers who were in the service prior to that year receive the value of their commissions from the Army Purchase Commissioners.

**Selvagees**—Are formed of returns of spun yarn turned into a circular form and bound together. They are used for the purpose of attaching the hooks of a tackle, the selvagee being passed round the object and the tackle hooked to the bights.

**Semaphore**—A mode of communicating intelligence by means of signals, which was in use before the introduction of the electric telegraph. It consisted of a tower, on the top of which there was certain machinery, consisting of movable arms for making the required signals. The towers were always placed on the most conspicuous and commanding sites. The rapidity with which messages were sent was remarkable, the time at Greenwich (1 o'clock) being sent to Portsmouth within ¾ minute.

**Senior**—In the army, one who is above another, either in regimental or army rank.

**Seniority**—Priority given to a regiment or an officer; it has reference to the date of the raising of the former or the date of commission of the latter.

**Sentence**—The judgment of a court-martial in allotting the punishment of a convicted soldier. The punishment to be awarded is arrived at by the votes of every member of the court.

Before deciding as to the quantity, the court should settle as to the nature of punishment. In all cases the opinion of the majority should be absolute, but if the votes are equal, the more lenient sentence should be given. No sentence of death can be passed unless two-thirds of the members of the court concur therein.

**Sentinel**, or **Sentry** (Italian, *sentinella*)—A soldier placed in such a position as to be able to watch the approach of the enemy, to prevent surprises, to stop any person who would endeavour to pass his post without an order, or without stating who he is. Sentries are placed before the arms of all guards, at the tents and quarters of general and commanding officers, or over any person or property to be guarded. All sentries are to be vigilant on their posts; they are not on any account to sing, smoke, nor suffer any noise to be made near them. They are to have a watchful eye over the things committed to their charge. They are not to suffer any light to remain or any fire to be made near their posts in the night-time; neither is any sentry to be relieved or removed from his post but by the corporal of the guard. They are not to suffer any one to touch or handle their arms, or in the night-time to come within 10 yards of their post.

No person is to strike or abuse a sentry on his post; but when he has committed a crime, he is to be relieved and then punished according to the Articles of War.

In planting sentries, regard must be

had to the duty on which they are to be engaged. Picket sentries, except under certain circumstances, must be double, and placed in the most advantageous position for hearing and observing any alarm in front. By day they should be placed on a height in the most commanding situation; but at night they should be withdrawn lower down, so as to be able to see any approaching party. When sentries hear people approaching them by night, they must challenge them, order them to halt, and allow only one person to advance until they are satisfied that they are *friends.* By day, sentries must not allow more than one stranger at a time to approach their post on any pretence. Sentries should be relieved every hour of the night. Mounted sentries are called vedettes (*q. v.*).

**Sentry-box**—A place of shelter for a sentry in bad weather or against the effects of the sun. It is made either of masonry or wood.

**Sepoy,** or **Sipahi**—Indian name for soldier, derived from *sip*, a bow and arrow, which Indian soldiers in ancient times were accustomed to carry. The word *sepoy* is given to a native of India who has enlisted into her Majesty's Indian army. The class of men who enlist are Hindoos, chiefly of the Rajpoot class, Mahommetans, Seikhs, and Goorkhas (hillmen).

**Serge** — A quilted cloth, made of woollen, and manufactured in many counties of England, especially in Devonshire. Serge was used very recently in the manufacture of gun cartridges, but it has been superseded by silk cloth. White serge is used for lining the panels of saddles.

**Sergeant**—A non-commissioned officer next in rank above a corporal. Sergeants are attached to a company, troop, or battery, for the purpose of aiding the commanding officer in maintaining discipline and good order, in instructing the soldier in his duties, and, in fact, in implanting in him all that is soldier-like and proper.

In the army, the name and rank of sergeant is given to two classes of non-commissioned officers, those who are employed in the various departments of the service, and those who have risen in and are attached to regiments of infantry, cavalry, batteries, and other branches. The former are classed as *staff sergeants;* the latter are known as *regimental sergeants*, with the exception of the sergeant-major, the quartermaster sergeant, the sergeant instructor of musketry, and the armourer sergeant of a regiment, who are also classed as staff sergeants.

The following are the names and duties of the sergeants of a regiment, troop, or company:—

*Armourer sergeant.*—A skilled mechanic attached to regiments of infantry, cavalry, and to the engineers, for the purpose of repairing and keeping the arms of the regiment in order.

*Band sergeant.*—One of the sergeants of a regiment who is placed in charge of the band. He is responsible for the discipline and conduct of the men in the band. He does not instruct them in music; this is left to the bandmaster.

*Colour sergeant.*—The senior sergeant in a company of infantry. He assists in carrying the colours.

*Cook sergeant.*—A sergeant appointed to look after the culinary department of a regiment of infantry, a brigade of artillery, and of the engineers; two are allowed to the latter corps.

*Drill sergeant.*—An assistant to the adjutant in carrying out the drills of a regiment.

*Hospital sergeant.*—There is no such non-commissioned officer now in the army, the duties of hospital sergeant being performed by the staff of the army hospital corps (*q. v.*).

*Lance sergeant.*—An acting sergeant.

*Orderly sergeant.*—A sergeant who is on duty for the day. His duties consist in superintending the routine of the corps.

*Pay sergeant.*—A sergeant who keeps the accounts of the company, troop, or battery, under the supervision of the captain in command.

*Paymaster sergeant.*—An aid to the paymaster.

*Pioneer sergeant.* — The non-commissioned officer in charge of the pioneers of a regiment.

Provost sergeant.—A sergeant specially selected—with reference to his fitness for the position, from the regiments in garrison, provided the strength of the garrison is not under two troops or companies—to take charge of the prison cells, to see to the safe custody of prisoners, for which he is responsible, and to carry their sentences into effect; it is also part of his duty to perform the police duties of the barracks, &c.

*Saddler sergeant.*—A sergeant attached to cavalry regiments to superintend the repairs of the saddlery.

*Sergeant instructor in fencing.* — A sergeant attached to each cavalry regiment, to instruct the officers and men in the art of fencing.

*Sergeant instructor of gunnery.* — A sergeant appointed to assist the gunnery instructor, attached to each brigade of artillery.

*Sergeant instructor of musketry.*—A sergeant attached to each line regiment, and two to the engineers, whose duty it is to assist the instructor of musketry in teaching the use of small-arms.

*Sergeant master tailor.* — A non-commissioned officer who superintends the tailoring of a regiment. He is taken from among the soldier tailors instructed at the Royal Army Clothing Depot at Pimlico; it is not, however, necessary that he should be educated at the above depot, as a civilian tailor on enlistment, after undergoing the prescribed examination in his trade at the Royal Army Clothing Depot, can be appointed to that post.

**Sergeant-Major**—The senior non-commissioned officer in a regiment. His duties are of a very important nature, as will be realised when it is considered that he is the adjutant's right-hand man. In him should be embodied all that is manly, soldier-like, and zealous. His duties are so manifold that for the proper performance of them he should be the smartest and most intelligent man in the regiment, and his example and conduct such as shall cause him to be esteemed and respected by every soldier in it. Besides the sergeant-major of a regiment, there are *troop sergeants-major* in the cavalry, and *battery sergeants-major* major in the artillery.

**Sergeants-at-Arms**—Formerly a sort of body-guard attendant upon the person of the sovereign or of the lord high steward when sitting in judgment on a traitor. They numbered about thirty. The functions of this body have long ceased.

The Houses of Lords and Commons have each a sergeant-at-arms, both of whom execute the commands of the house to which they belong, as regards the apprehension or custody of all persons committed by order of parliament. The office is usually held by a military man, who is seldom under the rank of a field officer.

**Serpents**—In pyrotechny, decorations with which rockets are charged.

**Servants, Military** — Soldiers taken from the ranks for the purpose of waiting upon officers. This privilege of having a soldier servant is not granted on Indian service, or where a colonial allowance is granted in lieu of servants. Each *infantry* regimental officer is allowed to have *one* soldier to attend on him; field officers and adjutants keeping horses for regimental purposes, as well as all *cavalry* officers when present at headquarters or employed on duty, *two* each.

**Service**—This word, as far as it is applied to military affairs, admits of a variety of significations, but in a general sense it means all duty performed by an inferior under the influence of a superior from the time he enters his service in any capacity whatever. In the army, the term is used to express the amount of time a soldier has followed that profession in an active manner, and is commonly expressed thus, "He has been some years in the *service*," or, "He has seen much *service*;" the latter implying that a certain degree of experience has been acquired by being in actual contact with an enemy. The term also points out the particular profession to which a man belongs, as *land service*, or *sea service*, meaning in the army or the navy.

**Set**—In artillery, another term for the "dip" of an axle-tree arm.

**Setter, Fuze**—A wooden instrument, the mouth of which is slightly hollowed out; it is used with the aid of a mallet to set the fuze into common and diaphragm shells. Mallets and setters are issued with garrison S.B. guns, and form part of a set of fuze implements.

**Sewing-machine**—A machine which now performs what the sewing-needle h handwork can do. It is largely used military clothing factories and in other military establishments.

For a description of the various sewing-machines in use, *vide* Ure's 'Dictionary of Arts, Manufactures, and Mines.'

**Sextant** (Latin, *sextans*, the sixth part; the limb of the instrument being a sixth part of a circle)—An instrument for measuring the angular distance of objects by means of reflection.

The *pocket sextant* is an instrument used in surveying; it enables the surveyor to measure the actual angle between any two objects to a single minute. It requires no support but the hand, and is easily adjusted. The present pattern pocket sextant (without telescope) is somewhat smaller than the former pattern; it is bronzed, and is attached to the case by bayonet joints instead of by a screw. The dark glass is fixed in an improved manner.

**Shabraque** (German, *Schabracke;* Polish, *czabraq;* Turkish, *tschaprak*)—A large-sized saddlecloth placed over a cavalry or horse artillery officer's saddle. There are two kinds, the undress and full dress.

**Shackle**—In artillery material, is the iron ring attached to a triangle gyn, from which the block and tackle are suspended. It is fastened to the upper part of the prypole and cheeks by means of a bolt called the "shackle bolt." The term is also given to the ring at the end of the shaft of an anchor.

**Shaft**—In military mining is the perpendicular passage sunk from the surface of the ground to the required depth, from which the branches of the mine diverge, termed "galleries" (*q. v.*). The common mode of proceeding is to sink a square shaft or well to the necessary depth, and from the bottom of this shaft to drive out a gallery of the length required, so as to lodge a sufficient charge of gunpowder in a chamber at its extremity, which, by its explosion, will destroy the enemy's works. Shafts and galleries are lined with timber to prevent the soil from breaking in.

In machinery, a cylindrical bar of iron fixed in the wall or any convenient position in a workshop for conveying the *power of the* prime mover, generally a *steam-engine*, to the work. Drums are fixed to the shaft, over which the belting is placed that turns the machines.

**Shafts**—In draught, consist of two wooden poles attached to carriages of all natures, between which one of the wheel horses is placed and harnessed. They consist of an off and near shaft; the former fixed to the axle-arm outside the wheel, passing through an iron loop underneath the end of the splinter bar; the latter in the same position as the pole formerly occupied, viz. underneath the centre of the splinter bar, where it is pinned and keyed from above.

**Shako**, *vide* Chaco.

**Sham Fight**—Not real, pretended fight.

**Shank of an Anchor**—The shaft or principal part of an anchor, to one end of which the flukes are attached, and to the other, the shackle.

**Shaping Machine**—A machine particularly adapted for shaping levers, cranks, and connecting rods, also for work in general. It is the invention of Sir J. Whitworth.

**Sharp Affair**—A contest in war of a vigorous nature.

**Sharpshooter**—A good marksman. A term formerly given to riflemen.

**Shears**—An instrument for cutting sheet metal and other metallic articles.

**Shear-steel**—A steel produced from blistered steel, which, to prepare it for forging into edge-tools, requires to be condensed and rendered uniform by the process of *shearing*. The process is also called *tilting*, on account of a tilt hammer being used.

**Sheave**—A solid wheel fixed in a block and turning on a pivot. A groove is formed on the circumference of the wheel, in which the rope runs, the wheel revolving with it. The object of the sheave revolving with the rope is to remove, to a certain extent, the friction, which would otherwise prove a great impediment to the efficiency of the power. Two or more sheaves are placed in a block when so required.

**Sheep-shank**—A knot in common use, serving to shorten a rope without cutting it or unfastening the ends. This knot is formed by doubling the rope in three parts and taking a hitch over the bight at each end with the other rope.

**Sheers**—Apparatus for raising heavy weights. In the artillery service, they are used for raising guns out of boats, also for raising them on the ramparts of a fortification and other positions in a fortified work where the gyn cannot be used. They are formed of two heavy masts or spars set across each other at the upper ends, and steadied by guy ropes made fast to pickets or some other convenient object. There are three natures, *ordinary*, *lever*, and *gyn sheers*.

**Shell**—A hollow projectile, formerly called a bomb (*q. v.*), containing gunpowder or some other explosive compound, so arranged that it shall explode by means of a fuze at a certain point and time, and spread destruction around by the forcible dispersion of its fragments.

Since the introduction of rifled ordnance, a shell of an elongated form has become the most common kind of projectile; it is exploded by means of a fuze, either time or percussion, with the exception of the Palliser shell.

The different natures of shell used with rifled guns are—with B.L.R. guns, the *common*, *segment*, and *Shrapnel* (Boxer) shells; those with M.L.R. guns, of the Woolwich construction, are the *common*, *Shrapnel* (Boxer), and *Palliser*. For other natures of rifled guns, the same pattern shells are used, with the exception of the Palliser; there are also in the service a *double* and a *star* shell, as shown below.

A *common shell*, either for B.L.R. or M.L.R. guns, roughly speaking, is a hollow cylindrical casting having an ogival head. It is filled with powder which forms the bursting charge, and is fitted with either a time or percussion fuze (*q. v.*), according to the nature of ordnance from which it is fired.

The use of this shell is for all purposes where great destructive effect is required, such as against men in masses, buildings, shipping, and material generally, either by bursting during flight or at rest, when the shell acts as a mine. It is used particularly in the field when the enemy is sheltered from direct fire, or against cavalry to frighten the horses and create confusion.

*Shrapnel shell.*—This shell is similar to the common shell in its external form, but it is filled with bullets (sand shot), cemented together with rosin; the head is of conoidal shape, riveted on to the cylinder which forms the shell, and has a gun-metal socket in it to receive the fuze. The shell is ignited, as shown in B.L.R. guns, by means of a time or percussion fuze. The bursting charge is at the base of the shell, which in this position serves to give an onward impetus to the balls in the direction of the line of fire on the bursting of the shell. The object in using Shrapnel shell is to give the projectile at long distances the power and efficacy of case shot; it is most effective when used against masses of troops, and the fuze should be so adjusted as to cause the shell to burst some little distance (between 50 and 100 yards) short of the object fired at. The original Shrapnel shell was invented by General Shrapnel, R.A., and was introduced into the service in 1808. It was then a hollow sphere filled with bullets; it has since the introduction of rifled guns been modified and made of a cylindrical shape by Colonel (now General) Boxer, and is known as the Boxer Shrapnel.

The value of Shrapnel is thus described by Lieut. E. Clayton, R.A., in his prize essay of 1873:—"Shrapnel is by far the most effective projectile against troops of all kinds, under such cover as shelter trenches, gun pits, or woods. Shells are effective if they burst in the right place, but their effect is altogether lost if they do not do so, whereas Shrapnel covers a large space of ground with its effects.

"Against artillery, Shrapnel also has the best effect, as the fire of a battery is more quickly silenced by placing the men and horses *hors de combat* than by dismounting the guns themselves.

"Shrapnel is not so efficacious against fieldworks as common shell, but against embrasures most effective, as it would destroy the gunners at their guns."

*Segment shell.*—Consists of a thin cast-iron cylindro-conoidal shell, enclosing a series of segments of the same metal, cast separately, and built up in layers on an iron disc having a cylindrical chamber in the centre. The segments are held together by a thin coat of alloy of lead and antimony, which is run over the surface of the shell from the base to the shoulder; the alloy also runs into the interstices between the segments, and coats the powder chamber. The form of the outer portion of the lead in this shell is the same as that of the solid shot and common shell; a small bursting charge is used with it. It can be used as shot, shrapnel, or case. This nature of shell is no longer issued to M.L.R. batteries, but is still retained for the use of B.L.R. guns.

The object originally of introducing the segment shell was that it might, by its construction, take the place of common shell, which, it was found, did not break up into sufficiently small pieces. Then it was hoped that it would act as Shrapnel, but again it was observed that, from the bad shape of the segments, it did not fly forward with sufficient velocity, and scattered too much. Again, fired with a time fuze, it was not reliable as to bursting at the exact moment required; so it was not considered efficient as Shrapnel, and contained too small a charge of powder to make it useful as a common shell against buildings, field-works, &c.

*Double shell.*—A shell similar to a common shell, but of greater length, the 7-inch shell being 4 calibres long. It contains a larger bursting charge, and is intended, owing to its great length, for use against wooden ships; up to 2000 yards it has given good results. There is only one nature of double shell in the service, the one described and that used with the 7-pr. The latter is for high-angle firing with a low charge (4 oz.); it carries a large bursting charge, and would be effective against houses.

*Palliser shell.*—A common shell, fired from the 7-inch gun and upwards. It is cylindro-conoidal in form, having an ogival head. The body is cast in sand, the head in an iron mould; it is fitted with a gun-metal plug screwed into the bush at the bottom of shell to close the filling-hole. This shell is fired without a fuze, and breaks up and explodes on striking an iron object; it is used against iron-clad vessels.

*Star shell.*—A thin iron shell used with the 7-pr. M.L.R. guns, filled with stars, and intended to light up an enemy's position at night.

It contains six stars of magnesium light composition, burning about 13 or 14 seconds, and seven stars of signal light composition, burning about 34 or 36 seconds. It is complete in itself, having the burster (½ drachm of R.F.G. powder) with quick-match priming arranged in the interior, and only requires the time-fuze to be prepared and fixed when required for action. By adopting a code where certain words are represented by different colours, a complete system of communication might be kept up between two bodies of troops at a considerable distance from each other.

**Shell, Diaphragm,** *vide* Diaphragm Shell.

**Shell, Incendiary,** *vide* Incendiary Shell.

**Shell, Mortar,** *vide* Mortar Shell.

**Shell, Water,** *vide* Water Shell.

**Shell, To**—To assault a place by means of shells; to bombard.

**Shell-lac,** *vide* Lac.

**Shelter Pits**—Pits dug for the protection of skirmishers, which the men should be able to make for themselves. In most instances, as described in the 'Instruction in Military Engineering,' the men will only have to improve natural cover, but it may be necessary to dig small pits which may be called *shelter pits*, in contradistinction to the larger pits required at sieges, &c., which are called rifle pits. Each shelter pit should be for one man only. Such a pit may be made in about 5 minutes; the depth need not be uniform, but should be about 10 inches where the man's body will be, and about 6 inches in other parts.

**Shelter Trench Exercise,** *vide* Exercise, Shelter Trench.

**Shelter Trenches** — Trenches constructed in the presence of the enemy to provide cover for troops exposed in the field to the action of shot and shell. This can be best obtained, where natural cover is not at hand, by means of small trenches called *shelter trenches*.

As explained in the 'Instructions in Military Engineering,' "it is essential that there should be ready means of getting in and out of these trenches both to the front and the rear; it is also desirable that they should not offer any great impediment to a forward movement, and that troops should be able to march straight over them when necessary. At every 100 yards or so, to enable guns, cavalry, &c. to pass, slight ramps should be formed or intervals left in the trenches, which may at these places be made to overlap.

"The most rapid way for infantry to obtain cover is by the excavation of a trench 2 feet wide and 1¼ foot deep; the earth is thrown to the front, so as to form a parapet 1½ foot high, the interior slope being built up as steep as possible with sods, clods, &c. Such a trench can be executed by men with their accoutrements on, and distributed at from 4 to 6 feet intervals in from 10 to 20 minutes."

**Shield**—Defensive armour of very ancient date, and worn even at the present day among nations where civilisation has not made much progress. Shields have been made of wood, iron, and basket work, and were carried on the left arm in defence, while the right arm wielded the sword or spear.

The term *shield* is also given to those massive structures of iron which are used as outer casings to the granite or brick walls of masonry of a fortification, or as covers to embrasures. Shields of all dimensions, representing the sides of plated armour ships, are set up from time to time at Shoeburyness, for the purpose of testing their resistance against rifled projectiles.

**Shoeburyness**—A locality in the county of Essex where ordnance experiments are carried out. As far back as 1842, ground was set apart at Shoeburyness as ranges for the use and practice of artillery. Since then it has become a school of gunnery for the regiment of artillery, where two courses of instruction are carried out, viz. the *long* and *short course.* (*Vide* Schools, Military.)

Detachments of the volunteer artillery are sent yearly to Shoeburyness for a training lasting a fortnight.

**Shoes, Horse,** *vide* Horseshoes.

**Shoes, Powder,** *vide* Goloshes, Leather.

**Shoot, To**—To discharge a fire-arm.

**Shot**—A name given to all kinds of balls used *for artillery and fire*-arms. *For artillery purposes they* are classified *as elongated, round* (*solid* and *hollow*), *case* or *canister*, *grape*, *bar*, *chain*, *stone*, and *chilled shot.* Since the introduction of rifled artillery, elongated shot have been introduced into the service, and are used with both breech-loading and muzzle-loading guns; with the former, Armstrong's solid shot; and with the latter, Palliser's shot of 12-inch, 10-inch, 9-inch, 8-inch, and 7-inch calibres. (*Vide* Projectiles.)

**Shot Bearers,** *vide* Bearers, Shot.

**Shot Bottom,** *vide* Bottom, Shot.

**Shot, Hollow**—A hollow sphere of iron, formerly used with shell guns; now obsolete.

**Shot, Hot,** *vide* Hot Shot.

**Shot Sling,** *vide* Sling, Shot.

**Shot-garlands**—Stands on which shot and shell are piled; they are used to retain shot placed on defences, and are made either of iron or wood. Hitherto, garlands have been made of cast iron and of a square pattern, but they are ordered to be used up and replaced by wrought iron of a rectangular form. They preserve the shot from deterioration, and it is usual to place a tier of unserviceable shot under the serviceable pile.

**Shovel**—An instrument made of iron, with slightly turned edges and a handle; it is in very general use for removing the earth loosened by the pickaxe. Engineers and working parties use this instrument very commonly.

**Shoulder Angle**—In fortification, is the angle formed by the meeting of the face and flank of a bastion.

**Shrinkage**—A process pursued in the manufacture of rifled guns. It is thus explained in the 'Text-book of the Manufacture of Rifled Ordnance,' by Captains Storey and Jones, R.A.:—

"When two coils are prepared for shrinking, that is, when their surfaces which are to be in contact are brought to their proper dimensions and to the necessary degree of smoothness, the excess of the exterior diameter, AB, of the inner one above the interior diameter, CD, of the outer one, both coils being cold, is termed 'the shrinkage.'"

The principle of shrinking on successive layers of wrought-iron coils affords very great strength to the system of building up guns, since by its aid the strain of discharge is transmitted to the very exteri of the gun, which thus adds its quota to the resistance.

**Shunt Gun**—A muzzle-loading rifled cannon, introduced by Sir W. Armstrong, on what he terms the *shunt* principle. In the shunt gun, the projectile is introduced into the piece on ribs or buttons, but with this peculiarity, that the projectile enters by one set of grooves and comes out by another set. Or, as explained by Lieutenant-Colonel Owen, " when the shunt gun is loaded, each stud presses against the loading side of a groove, and runs easily home, being *shunted* on its way down into the narrow portion of the groove; but on coming out again, it presses against the driving side, and near the muzzle rises up the incline into the shallow part, or on the high level, and so is slightly compressed; the projectile therefore leaves the bore fitting tightly, and with its axis stable."

**Sick and Wounded**—Men disabled, either by sickness or wounds.

Hospitals (*q. v.*) are established in the army for the better care of the sick and wounded, and a new organisation has been approved, for attending upon the wounded on the field, by means of ambulance establishments. All slight cases of illness are attended to on the spot by regimental surgeons. The field hospital receives all patients who require more careful treatment and diet than cases of an infectious nature, which are sent to a hospital appointed for that purpose. All regimental transport for the conveyance of sick and wounded has been abolished.

Sir G. Wolseley states that, " with an army actively engaged in the field, the proportion of sick and wounded to the strength of the force may be estimated thus:—

| | |
|---|---|
| " Sick .. .. | 10 per cent. |
| Wounded .. .. | 16 „ |
| Total .. .. | 26 per cent. |

" But it will only be necessary to provide hospital accommodation for—

| | |
|---|---|
| " Sick, constant daily average .. | 5 per cent. |
| Sick, reserve .. | 5 „ |
| Wounded after a general action | 5 „ |
| *Total* .. .. | 15 per cent." |

It is computed that the proportion of wounded to that of killed, during a general action, is 4 to 1. (*Vide* Ambulance and Geneva Convention.)

**Sickleghar**—An Indian term. A native of India employed in arsenals for cleaning metal work.

**Side Arms,** *vide* Arms, Side.

**Sidereal Day,** *vide* Day, Apparent Solar.

**Siege** (French, *siége*, a seat, from the sitting down of an army before a beleaguered place)—A siege is a regular organised attack on a fortified position, by means chiefly of artillery. The approach to the place is carried on under cover of trenches, termed *parallels*, *saps*, *galleries*, &c. Since the introduction of rifled guns several changes have taken place in siege operations, such as the mode of attack, the position, distance, and construction of batteries, the opening of the several parallels, &c.—all brought about by the superior fire of the guns and small-arms of the present day, so that the method hitherto of attacking a fortified place has had to some extent to be modified.

The capture of the many fortresses in France by the German army during the war of 1870–71 affords many instructive lessons as to the mode to be adopted in future sieges.

In all operations attending the investment or attack of a fortress, victory must previously have crowned the arms of the investing force; and in order to capture the fortress, either a numerical or moral superiority is necessary. The strength of the besieger's force should enable it to surround the place on all sides. In this position the besieger is liable, should the defender be in force, and capable of giving battle outside the walls of the fortress, to fight a series of battles before the besieged are driven within their stronghold. During this period, however, a good reconnaissance of the fortress can and should be made, which will enable the general of the besieging force to select a point on which the attack is to be directed, and to proceed with the construction of the necessary batteries and approaches to aid in effecting a breach and subsequently an entrance into the place.

It is very necessary that the point of attack should be decided upon from the commencement of operations, as all ulterior arrangements depend upon it, such as the extent of front of the siege works, and the measures necessary to be undertaken for capturing other works; and especially is the siege park guided by it, as well as the position of intermediate depots, &c. In these days of railways it is recommended that the choice of the front of attack should be such in which a railway is available for the transport of guns and ammunition, which are now, from their size and weight, not so easy to move as formerly. This consideration is most necessary, and will have great weight in the decision of the point to be attacked, so much so that it is doubtful whether a successful attack could be made on a large fortress, favourably situated with all resources at its command, and gallantly defended, if the besiegers have not such transport at their disposal. This has reference to fortresses with modern appliances, and such as would be found in future sieges.

From the moment the point of attack is settled upon, the object of the besiegers will be to construct their batteries at such distances and in such positions as will enable them to effect the object of the operations, viz. making a feasible breach in the ramparts of the fortress. The distance at which the besiegers' guns will be opened will depend upon the energy of the defence. Should the besieged not be driven within the fortress after the besiegers appear before it, for a considerable period, the first position batteries of the besiegers will have to be planted at distances varying from 1500 to 2500 yards from the works, but dependent also upon the ground and the distance the enemy's outposts are placed in front of his works.

The attack of a place is a succession of making and moving on batteries nearer to the place, and of pushing forward the outposts until the ground is gained on which the first parallel is to be thrown up, which nowadays would be constructed at some considerable distance from the fortress. This distance depends, however, upon the position of the outposts, consequently upon the energy of the defence, and upon the ground. It is suggested by Kraft, Prince of Hohenlohe-Ingelfingen, "that if the attack is opened from the *first artillery* position, the first parallel can be established with greater certainty and with less loss, by gradually pushing forward the outposts up to the ground where the first parallel is to be opened, throwing up shelter trenches between the positions of the outposts, and afterwards lengthening and widening them into the first parallel."

After fixing the first parallel, the next step will be to establish the batteries of the second artillery position. Those of the first position were at too far a distance to insure certainty of hitting, so that it becomes necessary to open fire nearer to the place. The batteries now placed include those for direct, ricochet, and high-angle firing, counter batteries, and batteries for breaching and demolitions. The guns used for high-angle firing would form breaches by curved fire, and act as counter batteries or for demolitions. The distance at which the second position of guns would be placed, would be somewhat less than half the distance of the first. Third or fourth parallels are constructed, leading on to the "crowning." Then comes the approach to the glacis and subsequent descent into the ditch and the passage of the ditch. When each of these is accomplished, the breach having been reported practicable, the storming takes place.

The duration of sieges depends on circumstances; some fortresses take weeks and months to reduce. Though the penetrating power of the arms which would now be used at a siege is far greater than it used to be, but principles in carrying on a siege remain much the same as they were.

The following information on commencing a siege, giving a general idea of the number of men and quantity of material considered necessary, is abridged from Sir John Jones' 'Peninsular Sieges.'

The number of men required for a siege depends on certain contingencies, of which the general in command is alone capable of judging. Certain points have to be looked to before commencing the siege, such as how many reliefs the troops shall have, that is, the proportion of rest to duty, and the strength of the force with reference to their ability to cope with the garrison of the place to be attacked. These points being ascertained, the detail of the work to be performed follows. For the guard of the trenches, three-fourths of the strength of the garrison should be the minimum calculation. This duty is for a short service with three reliefs. The workmen, however, cannot do with less than four reliefs. Supposing the front to be attacked to be 180 toises, with a ravelin, and the length of the first parallel to be opened the first night be about 4000 yards, it would require nearly 3000 men. For the second night after operations had commenced, the same number would be required in the trenches. For the remainder of the siege, much fewer will suffice, say 2000 men.

Taking into account also the number of men required for other duties of the camp, &c., it is calculated that one-tenth of the whole army would be employed in conducting the siege. It may be assumed therefore that for the siege of a place with a garrison of 5000 men the following would be required:—

| | | |
|---|---|---|
| "Guard of the trenches, 3750, at three reliefs .. .. | 11,250 | (*Vide* 'R. M. A. Instruction in Fortification.') |
| Working parties, 2000, at four reliefs* .. .. | 8,000 | |
| | 19,250 | |
| General duties of the camp, one-tenth of the whole army, at four reliefs .. .. .. .. | 12,830 | |
| Total, independent of sick and casualties .. | 32,080" | |

"From this calculation, it is evident, *cæteris paribus*, that the more numerous the garrison the smaller the besieging army need be in proportion to it; for the attack of a similar front or fronts of fortification is little different if the place contain a garrison of 5000 or a garrison of 10,000 men; the guards of the trenches and the other duties increase proportionately, but the work does not.

"Hence it is that the most celebrated commanders and best engineers are agreed that, as a general principle, the besieging army should vary in its proportion to the strength of the garrison according to the numbers of the garrison; and as an approximation have fixed that proportion at 5 to 1 when the garrison consists of 15,000 men, 6 to 1 when of 10,000 men, 7 to 1 when of 5000, 8 to 1 when of 3000, and in still greater proportion when it consists of a less number."

The proportion and strength of artillery to be used in the attack of a fortress or any fortified place which it is necessary to capture, either by bombardment or breaching, will depend on a variety of contingencies, such as the size of the fortress, its strength, the number of guns in the place to be captured, &c.

The guns which form the siege artillery of the British army will be found under the head of Siege Train.

**Siege Carriage**, *vide* Carriage, Siege.

**Siege Park**, *vide* Park, Siege.

**Siege Train**—The men, guns, and material collected together for the conduct of a siege. The following shows the proportion of *personnel* and *matériel* of a siege train of 105 pieces:—

55 rifled 64-prs. } on travelling carriages with siege limbers;
20 rifled 40-prs. }
30 rifled 8-inch howitzers on travelling carriages.

The number of rounds per gun, as well as the charges to be employed, varies according as these are intended for direct, ricochet, or curved fire. Ten per cent. spare fuzes and 20 per cent. spare tubes, and a number of extra barrels of powder, should be allowed and provided above that which may have been calculated as adequate to the quantity of projectiles required. Besides these, a large proportion of gyns, handspikes, skidding tackles, &c. are provided. A train of the above nature would be also supplemented by mortars.

The number of men required for a siege equipment is computed to be as follows. Allowing 10 men per gun, 5 for large mortar, and 3 for small mortar, the proportion for three reliefs, exclusive of magazine and store duties, and a reserve to replace casualties, would be:—

---

* Would require nowadays to be more numerous.

30 men per gun;
15 „ per large mortar;
9 „ per small mortar.

**Siege Wagon**—A general service wagon fitted with movable trays for shot and shell.

**Sieve**—A netted utensil for separating the smaller particles of substances from the grosser. In the manufacture of gunpowder, sieves are indispensable for separating the different sizes of grain. They are made of wire of different dimensions, and are known by the number of meshes to the linear inch.

**Sight, Eye**—The power the eye has of distinguishing objects far and near. In judging distances, good eyesight is most necessary; in fact, defect in a soldier's vision renders him unable to shoot, and no recruit should be admitted into the service if the power of his eyesight is not adequate to meet the demand made upon it consequent on the increased range of small-arms of the present day, the length of which is about 1000 yards. This maximum range, or even an intermediate one, requires that the soldier who uses such weapons shall have a clear vision, and shall be able to judge correctly the distance of an object, the size of a man, in any position up to that extent of range.

The medical officer who examines the recruit is able to judge of his fitness or otherwise for the service as regards his eyesight, and is responsible that, before the recruit is admitted, he has undergone the examination and test laid down in the 'Manual of Instruction on Defective Vision,' published by Surgeon-General Longmore, C.B.

The original order on the subject of the examination stated "that men should not be received into the service who do not see well, to 600 yards at least, a black centre 3 feet in diameter on a white ground." The question then arose how this test was to be carried out. Surgeon-General Longmore devised a measure by means of test-dots painted on black discs, which, when held at a given distance, formed retinal images of the same size as the bull's-eye, 3 feet in diameter, at 600 yards distance. The size of each of the discs or test-dots was ¼ inch in diameter, and the distance at which it was to be held was 10 feet. This was considered a convenient distance, as the size of the small test-dot was found by a simple calculation of proportion, viz. as 600 yards : 3 feet : : 10 feet : ¼ inch.

The visual angle of the dot ¼ inch in diameter at 10 feet, then, being the same as that of the large bull's-eye 3 feet in diameter at 600 yards, it followed, other conditions being alike, that, if the recruit could distinguish clearly the small bull's-eye at 10 feet distance, he could equally see the 3-foot bull's-eye at 600 yards. The bull's-eyes were subsequently changed from circular to rectangular,* and the bull's-eye became 2 feet square, which the recruit was to see under the same circumstances as he before had looked at the round 3-foot centre; but to do this, the test-dots had to be held at a distance of 15 feet from the recruit.

It is shown in the 'Artillerist's Manual' that good eyesight recognises masses of troops at 1700 yards. At 1300 yards, infantry may be distinguished from cavalry, and the movements of troops may be seen, but the horses of cavalry are not quite distinct. A single individual may be seen at 1100 yards, but his head does not appear as a round ball beyond 700 yards. At 600 yards, white cross-belts may be seen. At 500 yards, the face seems a light-coloured spot; the uniform, head, body, arms, and their movements, can be made out. At 250 yards, buttons may be seen, and officers distinguished from men. Officers with bright scabbards and men with fixed bayonets can be discovered, on a clear day, at a distance of 1500 yards.

**Sight, Line of,** *vide* Line of Sight.

**Sights**—Small pieces of metal, fixed or movable, on the breech, muzzle, centre, or trunnions of a gun, or on the breech and the muzzle of a rifle, pistol, &c., by means of which a gun is levelled on the object to be struck.

In smooth-bore guns, *quarter-sights* are cut on the upper quarter of the base ring, and numbered up to 3°.

---

* They have again been changed back to circular. (Vide Addenda, Musketry Drill.)

The mode of elevating the gun is by bringing the division on the base ring expressing the required degree of elevation and the notch on the *side* of the muzzle in direct line with the object; the gun will then have the proper degree of elevation. To lay the gun point-blank, the lowest notch on the base ring and that on the side of the muzzle are brought directly in line with the object; and though the gun may have been laid point-blank with reference to the object, it may have several degrees of elevation or depression with regard to the ground or plane of the horizon.

Heavy smooth-bore ordnance are provided with *Millar's sights*, which consist of a graduated tangent scale at the breech, and a dispart sight in front of the second reinforce. A wooden tangent scale is also used for elevation over the *clearance* angle.

Heavy B.L.R. guns (Armstrong) are sighted with a *barrel-headed* and a *trunnion* sight on each side of the piece; the barrel-headed sight is held in a tangent ring or in a socket according to the nature of the gun, the slots of the tangent ring inclining to the left at an angle of 2° 16′.

A *barrel-headed sight* consists of a bar, elevating-nut, cross-head, two thumb-screws, and leaf. The whole is made of gun-metal, except the bar, which in most guns is made of steel. The bar is graduated on one side in degrees, on the other in yards. The degrees are divided into 6 parts of 10′ each, and any number of minutes up to 10′ each can be given. The cross-head is horizontal, and is graduated to give ½° of deflection either to the right or left, and this ½° is also divided into three parts of 10′ each on both sides; at each end of the slide is a graduated nut divided into minutes up to 10′, and these nuts are connected by a screw crossing the bar at right angles. A leaf with the sight-notch slides along the scale, and can be moved either right or left by either nut. These sights will become obsolete, on the guns to which they are attached being no longer required.

The *trunnion-sight* is of two kinds, viz. *drop-sight* and *screwed-in sight*. Certain guns have the former, other guns the latter. The drop-sight consists of a gun-metal socket, collar, and pillar, and a steel leaf. The socket fits into the gun, the collar locks into the socket, and the pillar, at the top of which the leaf is screwed, fits into the collar. The *screwed-in* sight is made of steel, and has a steel leaf dove-tailed into its top and screwed into a hole above the trunnion. The leaf is hog-backed in shape, and its rear surface roughened to prevent the reflection of the light interfering with laying the gun.

The sights attached to heavy M.L.R. guns are very similar to those of breech-loaders, with this difference, that, instead of the barrel-headed sight, they have a simple cross-head with sliding-leaf and clamping-screw attached to the *tangent sight* bar. This sliding-leaf head gives 30′ deflection right or left, and is only for use when one wheel is higher than another, or to allow for wind or some other inaccuracy. They have also a trunnion fore (drop) sight on each side of the gun, an hexagonal tangent scale graduated to 5°, and a dispart or fore (drop) sight on top of the piece; the breech tangent sights fit into sockets let into the side of the breech, and are inclined to the left, like those of a B.L.R. gun, but at different angles, the inclination of sight for the 7-inch gun being 3°, for the 8-inch 23′, for the 9-inch 44′, and for the 10-inch 1° 10′.

The 64-pr. and 80-pr. converted guns are each provided with a breech and trunnion sight on each side of the gun, but they have no top sights; a wood side scale is also supplied.

The 64-pr. wedge-gun (Armstrong) has an *hexagonal brass sight* (tangent scale), graduated to 5°, and a dispart or fore (drop) sight; the former on the top of the breech, the latter on the top of the trunnion-ring.

The 40-pr. and 25-pr. are side-sighted, having two tangent sights and screw trunnion sights of the usual pattern.

The field guns are sighted as follows. The 16-pr. is side-sighted, and has two tangent sights set at 1° 50′ to the left, and two steel trunnion sights screwed in. The tangent sights have rectangular steel bars with gun-metal sliding-leaf heads, and are graduated with degree, yard, and fuze scales.

The 9-pr. is central-sighted. Its tangent scale is inclined at 1° 30′, and is graduated to 6° and 12°, each degree being subdivided into 20 divisions of 3′ each. There is also a deflection scale graduated to 30′. The fore-sight is a small hog-backed sight, screwed into a recess in the dispart patch.

The 7-pr. M.L.R. gun is also central-sighted. The tangent scale is inclined to 3°, and has a plain head and no deflection scale; it is graduated up to 12°.

Small-arms are provided with two sights, viz. *fore-sight* and *back-sight*. The latter consists of a flap and a slide, which in the Martini-Henry is sighted to 1400 yards.

**Signal**—Any motion given by a sign. Signals in time of war are agreed upon for conveying intelligence to the different portions of an army previous to an attack or assault, so as to insure the movements allotted to each corps being carried on simultaneously. These signals may be given in various ways, as by the discharge of a gun, by signal rockets (*q. v.*), &c.

**Signal Lights,** *vide* Light.

**Signal Rockets,** *vide* Rocket.

**Signalling,** *vide* Telegraphy.

**Signs, Conventional**—Symbols used in topography to denote certain features of the ground which could not be otherwise shown. Thus, in the English survey maps, bridges are represented by two parallel lines with their ends bent outwards, churches are marked with a cross, railroads by thick parallel lines connected by thin cross lines.

**Silence, To**—In an action, "to silence the fire" of the enemy's guns is to disable his artillery in such a way that he is unable to reply.

**Silk Cloth**—A material now used for cartridges of rifled guns in lieu of serge.

**Sill,** *vide* Embrasure.

**Simultaneous Loading,** *vide* Loading, Simultaneous.

**Sine**—In geometry, a right line drawn from one end of an arc perpendicular to the radius passing through the other end. The sine of a quadrant 90° is equal to the radius.

**Single Lever Bridge,** and **Single Truss Bridge,** *vide* Spar Bridge.

**Sinnet**—A kind of knittle or line used as a *seizing*.

**Sissoo** (*Dalbergia Sissoo*)—A wood used in India in the construction of ordnance carriages and other work. As described by Conductor Skinner, the wood is close-grained, hard, and flexible, of a dark purple colour fading to brown. A cubic foot of unseasoned wood weighs from 60 to 65 lbs.

**Skeleton**—The framework of anything. In a military sense, the term is applied to the diminished state of a regiment from casualties in the field or from sickness.

The term is also applied, in conjunction with the word drill, to *skeleton drill*, which is a method of instructing officers and non-commissioned officers in drill, when a sufficient number of men cannot be collected to form a battalion in single rank. As explained in the 'Field Exercises and Evolutions of the Infantry,' a skeleton battalion is formed of companies composed of two, four, or eight men each, representing, if there are two, the flanks of the company; if there are four, the flanks of half-companies; if there are eight, the flanks of sections. The intervals between the flanks are preserved by means of a piece of rope held at the ends to its full extent. By this means any set or number of manœuvres may be performed.

**Skids**—Slabs of wood or iron of various dimensions placed under guns and stores to keep them off the ground; they are also placed under guns on being moved; and under such circumstances, when not moved by parbuckling, the skids should be watered.

**Skin, Lamb**—The skin of a lamb; it is used in a standing battery to put over the muzzle of a mortar or howitzer to prevent the fuze being ignited from sparks falling into the bore, also for wiping the bottoms of shells to free them from all sand and dirt that may have clung to them before loading.

Lamb skins are also used for mounted corps, and are placed over the shabraque, and also as a covering for the valise.

**Skins,** *vide* Leather.

**Skirmishers**—Soldiers acting in a loose and dispersed order in front of a battalion or body of troops; they form the first line of battle.

2 0 2

The employment of skirmishers dates from the wars of the French Revolution, when France, assailed on all sides, supplied great numbers of conscripts, who, from want of instruction and practice in discipline, were thrown out to fight in a loose order, where coherence and precision were not so much wanted as intelligence and courage. (*Vide* Light Infantry.)

Since then, skirmishing has become one of the formations of the line of battle, used in all modern wars, but it has lost the demonstrative character it formerly possessed, when it was simply utilised to engage and sustain the action, to clear up the situation, and to consume the strength of the enemy. The great power of rifled weapons has rendered skirmishing more decisive, or, at least, has made skirmishers the most important actors in a battle; it is upon skirmishers that now devolves the task of bringing on the satisfactory issues of a battle.

The experience of the war of 1870–71 has shown that it is not sufficient for troops fighting on the first line to deploy one-third alone of their effective numbers, keeping the remaining part as a reserve. On isolated occasions during this war, the tenacious employment on the part of the Germans of the close-order system, as well as a too extensive dispersion of their first line, proved disastrous, and made them adopt a formation which has been generally introduced into other armies. It was found necessary to deploy long lines of skirmishers, "clouds of skirmishers," amounting to many thousands of men, to lead them on to the decisive point, to make them strike at the enemy's weakest position, and to penetrate therein by a vigorous attack.

Skirmishers, to perform their work satisfactorily, must act together and with vigour, either to break the enemy's lines or to repulse, according to circumstances, the counter attacks of the enemy; they must be maintained in a regular order, "order in disorder," as a foreign writer expresses it, and be regularly reinforced by the supports, which, being placed at a certain distance behind them, are always ready to advance and feed the first line when the time comes.

To prepare for the final charge, by crushing the enemy with their fire, is the first aim of skirmishers; to support them when weakened, to push their line by successive bounds till they reach the enemy's positions, is the duty of the supports. The reserve follows in rear, becoming in its turn supports, according to circumstances, ultimately joining the skirmishers in the last attack, assisting in penetrating the enemy's position, striking the final blow, and in pursuing the enemy with its fire.

**Slat Bar**—The bar of a siege howitzer limber between the splinter bar and bolster, and connecting the futchels.

**Sledge Hammer**, *vide* Hammer.

**Sleepers**—Form part of a gun platform on which the flooring of the platform is laid, and to which it is fastened either by screws, spikes, or rack-lashings. Sleepers must be well embedded in cuts or trenches, and firmly fixed or pinned into the earth, then covered with planks, and finally completed with ribands and rack-lashings (*q. v.*) on each side.

**Sleigh**—A particular pattern of carriage used for the transport of artilliery in countries where much snow falls, such as in Canada. The carriages of the country are termed "sleds," and when artillery was sent to Canada in 1862, the sleds were found very useful and better adapted than our sleighs. The term *sleigh* is also given to the carriage on which heavy guns are moved in store. The mode of moving this nature of carriage is by means of rollers placed underneath the sleigh and worked by hand-spikes.

**Slew, To**—To slew a gun or mortar, strictly speaking, is to turn it on its axis without moving it from the spot on which it rests. This is called "slewing the trunnions." If the piece to be slewed rests on skids, a hand-spike is placed close to it on each skid, bevel up, and on that side of it towards which it is to be turned. This is then called "scotching," or "chocking."

**Slide-rest**—An appendage to the turning-lathe, so contrived as to hold a tool firmly to the work, and while cutting a shaving from the bar in the lathe, the tool is slid gently along and the bar is turned quite true. There are two slides to the rest, by the separate or combined motions of which the tool can be made to act along or across the work with great accuracy; the attendance of a workman may even be dispensed with, by attaching a *star* to the wheel, and an iron *finger* to the end of the work in the lathe: as the work revolves, the finger will bear down one of the points of the star, the effect of which is the same as turning the screw handle, by which the tool is moved along the surface of the work.

**Slide-valve**—A form of valve in which the opening and closing of the orifice is regulated by a sliding-plate. Its most common application is to the steam-engine, to govern the admittance of steam to and from the cylinder, its movements being controlled by a moving part of the engine called the *eccentric.*

**Sling**—A weapon used in the earliest ages. It consisted of a piece of leather with a round hole in the middle and two cords or strings, a round pebble being hung in the leather by the cords; the strings were held firmly in the right hand and swung rapidly round. The velocity communicated to the pebble was very great, and the range and force imparted much greater than could be given to it by the hand unaided. This weapon was in very general use before the introduction of fire-arms. It was used by the Saxons at the battle of Hastings.

The name *sling* is also given to a rope or band by which anything is suspended. In the artillery service it is very commonly used for hoisting guns, &c.

**Sling Cart**—A special kind of cart for moving heavy guns, not exceeding 65 cwt., and for 8- and 10-inch mortars, on hard and level roads. It weighs 15 cwt., and is a two-wheeled carriage, having wheels 7 feet in diameter. The gun is slung below the cart.

**Sling, Gun**—A sling for lifting a gun off its carriage or off the ground when placed under a gyn or other lifting machine. It is formed by splicing the ends of a length of white rope together, the dimensions of the rope varying with the weight to be lifted. For very heavy guns, chain slings are used.

*Guns should invariably be slung as short as possible. This becomes absolutely necessary when heavy guns are to* be raised, otherwise the tackle will be "chock-a-block" before the gun is sufficiently high to admit of the trunnions clearing the carriage.

**Sling, Shot**—A sling for carrying heavy shot or shell. It is made of canvas or gunny cloth.

**Sling Wagon**—A wagon made of wood or iron. It is employed in moving heavy ordnance, standing carriages, and traversing platforms, to longer distances than a sling cart is capable of doing. There are several sling wagons in the service, capable of carrying from 6 up to 23 tons and even greater weights. Each is fitted with a windlass. Lieutenant-Colonel Owen, in his 'Modern Artillery,' thus describes the sling wagon made of wood:—"The ordinary *sling wagon* consists of a wooden frame and perch, the eye of which hooks into a straight pintail on the limber, thus forming a four-wheel carriage; it has a *windlass* over the axle-tree, worked by levers, for raising the gun or mortar, the trunnions of which are supported by iron *thimbles* and a *sling* of 6-inch rope. The wheels are 7 feet in diameter, and the gun is slung below the wagon with its muzzle to the rear, the breech being lashed up to the perch; besides the gun, its carriage is also carried over the perch."

The iron sling wagon is of the same general form as the wood wagon in the body and limber.

**Slips**—Wrought-iron cylindrical cases about 4½ feet long by 2 feet 5 inches in diameter, in which wood for gunpowder purposes is distilled; the cases are fitted with lids, and are made to fit into iron retorts, which are imbedded in masonry in such a manner that the heated air from the furnace shall circulate freely round them, and thus convey an equable heat to all parts of the retort throughout the operation of charring. In each slip there are two holes, which correspond with similar holes in the retort, and through which the gases from the wood pass off in the process of distillation. The charge of dhall stalk (the wood used in India) for a slip depends upon the size of the wood. If of large size, the slip will hold 150 lbs., medium 70 lbs., and small size 50 lbs.

**Slopes** — In fortification, the inclination given to the earth in the formation of the ramparts and parapets, such as the *exterior* and *interior* slopes (*q. v.*), and expressed usually by fractions in which the numerator represents the height and the denominator the base of the slope. Thus a slope described as $\frac{2}{1}$ (or verbally as two in one) is one in which the vertical height is twice the base; whilst that expressed by $\frac{1}{2}$ (or verbally as one in two) is, on the contrary, one in which the base is double the vertical height.

Slopes of hills or mountains are expressed in topography by vertical or horizontal *hachures.* Uphill at 15°, slopes are accessible for guns, but at that degree their fire would be useless; at 30°, it would be difficult for cavalry to ascend, and at 10° to charge; at 20°, infantry cannot ascend in order, but slopes are accessible for skirmishers at 45°, at 60° inaccessible for infantry. Downhill, they are suitable for attack or defence for infantry at 10°, artillery 4°, and cavalry not more than 5°.

**Slot**—A long cut or narrow opening, cut in metal by means of a slotting machine. The application of the *slot* may be seen on the upper surface of the Armstrong gun in the cut made for the introduction and removal of the vent piece; in various other metal work slotting is commonly employed.

**Slotting Machine**—As described in Brande and Cox's 'Dictionary,' is a machine in which a tool moves vertically, in the manner of a mortising chisel, so as to cut out slots or mortises, or to pare round the edge of any object requiring to be made fair and smooth on the edge. Slotting machines are used for a great variety of purposes.

**Slow Time**—A pace of 13 inches and of 75 paces a minute, which is taught to recruits and marched at funerals. The instruction given in manual and firing exercises is performed in slow time.

**Slow-match,** *vide* Match.

**Slugs**—Cylindrical or cubical pieces of metal fired from a gun, rifle, &c. (*Vide* Cartridge, Buck-shot.)

**Sluice** (German, *Schleuse,* from *schliessen, to close*)—A flood-gate for regulating the *flow of* water. It is made either of wood *or iron,* usually sliding in a vertical frame.

**Sluice Gate** — In fortification, is a strong vertically sliding door, placed in a batterdeau, to regulate the flowing of the water in the ditch. Sluice gates are used besides for retaining and raising the water of a river or canal, and, when necessary, to give it vent.

**Small-arm Ammunition**—The ammunition used in the various small-arms of the service. It is now confined to the Martini-Henry rifle, Snider-Enfield, long and short, Lancaster, and Westley-Richards rifles. (*Vide* Appendix F.) In England, small-arm ammunition is made up at Woolwich; in India, at the factories in Bengal and Bombay.

**Small-arms**—Include all hand weapons, whether fire-arms or otherwise, such as muskets, rifles, carbines, pistols, swords, bayonets, lances, &c., a description of which will be found under their respective heads. The latest introduction is the Martini-Henry rifle, with which the British army is supplied. (*Vide* Appendix F.)

**Small-arm Cartridge,** *vide* Cartridge, Small-arm.

**Small-arms Factories, Royal**—Establishments in which the small-arms of the service are made, viewed, and repaired. The English government has a factory at Enfield, where the arms issued to the regular and auxiliary army are made, the factory being able, when in full work, to turn out, daily, a thousand and upwards of complete arms, tested and ready for use; at Birmingham, the government has also a large establishment for viewing the arms supplied by contract, and at Pimlico there is an establishment for repairing damaged arms, and for training armourer sergeants for detached service with regiments. All arms are made on the interchangeable system, so that the parts of any one rifle will fit the parts of any other when thrown promiscuously together.

**Smart Money**—A sum paid by a recruit to free himself from his engagement. This is done in the presence of a magistrate, and previous to attestation. The amount is 20s., which includes the enlisting shilling; the enlisting sergeant receives one-half (9s. 6d.), the remainder is credited to the public.

When a recruit is illegally or irregularly enlisted or attested, he is discharged with a protecting certificate, and the expenses are debited against the officer who signed the attestation.

A protecting certificate is always given to a discharged recruit to prevent his being apprehended as a deserter.

A recruit cannot legally be attested until 24½ hours have elapsed from receipt of the enlisting shilling; he can claim 95½ hours' grace before attestation. If the enlister neglects to have him attested within 96 hours after enlistment, the engagement is void and the recruit free.

Sundays, Christmas Day, and Good Friday, do not count as time against a recruit, though he may, if he wishes, allow them to count; thus a recruit enlisted on Saturday night cannot be attested against his will on the following Monday, although, if willing, he may be attested.

**Smelting**—The process of separating metals from the earthy and other matters with which they are combined in the state of ore.

**Smoke-ball**—Consists of a paper shell having one vent (the thickness of the paper depending on the nature of the shell); the shell is filled with a composition which, upon igniting, evolves a large volume of smoke. It is thrown into mines or other confined situations, to suffocate the enemy's working parties. It has also been used as a signal in the Arctic regions.

**Smoothing Plane**—A small hand plane without a handle or *toat*. It is used for smoothing the surfaces of bodies.

**Snaffle**—A horse's bit, and the most common bit in use.

**Snaking**—When the spiral motion of rotation of an elongated projectile round its original direction (caused probably by irregular resistance and want of homogeneity) becomes of exaggerated extent, the projectile may be seen to describe a sort of helix round its primary direction, and the accuracy of shooting is greatly influenced by the part of the helix which may first happen to come in contact with the ground. Projectiles subject to this influence are technically said *to snake*.

**Snap-cap**—A small *leather* cylinder with a metal top of the size of the hammer of a percussion musket, and fitting closely to the nipple. It is used to preserve the nipple from the action of the hammer. The snap-cap used with the Martini-Henry rifle is described in the 'Change of War Matériel' as follows:—

"The body of the snap-cap consists of an iron tube surrounded by one of brass, the latter being made somewhat elastic. Longitudinal slits are cut to allow of sufficient compression to insert the snap-cap into the bore of the rifle.

"The base is made similar to the base of a breech-loading rifle cartridge, but has a portion of the sides of the flange cut away to allow the horns of the extractor to pass, when the snap-cap is used at snapping drill.

"The interior of the snap-cap consists of a spiral spring, supporting a piece of ebonite, which receives the blow of the striker. The spiral spring is kept in its place by a screw at the head of the snap-cap."

**Snaphaunce**—A flintlock originally attached to muskets. It is said to have been invented in Germany about the end of the fourteenth century, and was so called by a set of Dutch marauders designated "Snaphans," or poultry stealers, who, finding the light of the match betrayed them in their marauding trips, and the wheel-lock too expensive, used a lock consisting of a piece of steel, furrowed like the wheel of a wheel-lock, set on a steel post, and which moved on a pivot, and a cock in which was fixed a flint instead of a piece of pyrites; the priming pan was provided with a cover, which, when it was required to fire the arm, was pushed on one side, and the steel bent down over the pan; on the trigger being pressed, the cock with the flint fell on the steel, and forced it back from the pan, evolving at the same time sparks which fired the priming. The improvement on this lock gave us our flintlock, which has now become an arm of the past.

**Snatch Block** (Dutch, *snaaken*, to seize hastily)—A block with a single sheave; it has an opening on one side, to allow the rope being placed in or out of the block without putting its end in first. It is closed by means of a hook and staple.

**Snider Rifle**—Originally the Enfield rifle, but subsequently converted into a breech-loader, deriving its name from the inventor.

The length of this rifle (long), bayonet included, is 5 feet 11½ inches, and it weighs 9 lbs. 14½ oz. The barrel is 3 feet 3 inches long; the bore is ·577 inch in diameter, and is rifled with 3 grooves, each forming a regular spiral of one turn in 6 feet 6 inches.

The bullet is 1·04 inch long, and ·575 inch in diameter; its general figure is cylindrical, but round in front. In its base a conical-shaped cavity is formed, closed by a plug made of baked clay. In the head there is another cavity, cylindrical in form, which is left empty and closed over with lead, and which serves both to readjust the position of the centre of gravity and to permit the bullet to be made of greater length without increase of weight. The diameter of the bullet is ·002 inch less than that of the bore; but as the first shock of explosion is received by the clay plug, the latter is driven into the conical cavity in the base of the bullet, thus causing the lead to bulge with tolerable uniformity, and at once to fill the grooves, which in consequence of their spiral twist impart to the projectile a rotary motion round an axis coincident with the line of flight.

The weight of the bullet, with its clay plug, is 480 grains, the charge of powder is 72 grains (about 2½ drs.). The mode of igniting is that known as the central-fire system, there being a cap in the base of the cartridge which is exploded by means of a piston passing through the breech lock. The rifle is sighted up to 950 yards, but its practice is good at a longer range. (*Vide* Appendix P.) The militia and volunteers, and many of the native infantry regiments in India, are armed with the Snider rifle (long); the royal marine artillery and sergeants of militia and volunteer corps are provided with a shorter rifle of similar construction to the foregoing. Its length, with sword-bayonet, is 5 feet 3½ inches; its weight is 10 lbs. 8 oz.

Rifled carbines, breech-loading, on the *Snider principle*, are supplied to the *cavalry and to the* artillery, the ammunition being the same as for the Enfield rifle. The length of the artillery carbine is 5 feet 4½ inches, and its weight 9 lbs. 3 oz., including the sword-bayonet, which is of the same dimension as that supplied with the short rifle. It is sighted up to 600 yards.

The cost of altering an Enfield to a Snider varies from 15s. to 20s. More than a million have been converted, and the factories can turn out 1100 rifles daily. (*Vide* Appendix F.)

**Snifting Valve**—As described, is "the air or blow-valve in a condensing steam-engine. It receives its name from the peculiar noise made when, the air having all bubbled out of the cylinder (from the steam being let in), the steam begins to follow, and, instead of escaping in bubbles, is instantly condensed by the water with a kind of decrepitation."

**Snow**—Congealed water, which falls from the atmosphere. Snow flakes in their fall assume various forms or classes of crystal, chiefly belonging to the rhombohedral system.

The density of snow, with which we are chiefly interested, having reference to the penetration of projectiles into it, is less than ordinary ice. Under the latter head will be found the result of experiments on the penetration of projectiles into snow and ice.

**Society, International, for the Sick and Wounded,** *vide* Geneva, Convention of.

**Socket**—Any hollow pipe which receives something inserted into it, such as the socket of a bayonet, &c.

*Sockets* are attached to rifled ordnance for holding the tangent scale. Each socket contains a slot for the tangent scale, to which the sight is attached, and which fits into the side of the breech, and is prevented from turning by a projection which dovetails into the metal of the gun. The sight is provided with separate moveable clamps. The slots in B.L.R. guns are inclined to the left, at an angle of 2° 16′. In M.L.R. guns, similar arrangements are made; but the breech tangent sights are inclined at different angles.

The *portfire socket* consists of a metal tube or receptacle for receiving a portfire. It is so made that one-half of the socket falls back on a hinge to receive the portfire, and is closed again with a running ring.

**Sod Revetment,** *vide* Revetment.

**Soda-water Bottles,** *vide* Bottles, Soda-water.

**Sods**—In fortification, pieces of turf with which works are faced.

**Sola**—The name of a plant, stated, in Balfour's 'Cyclopædia', to be common in moist places, and, in the rainy season, in many parts of the plains of India. It belongs to the genus Æschynomene. The plants are remarkable for their light and spongy texture, and seem indeed to be composed almost entirely of pith. This light substance is collected in the dry season, and applied to a variety of uses, particularly in the manufacture of hats which afford a good protection against the sun. This nature of hat is commonly worn by soldiers, in India, off parade.

**Soldering**—As described in Weale's series, "is the process of uniting the edges or surfaces of similar or dissimilar metals and alloys by partial fusion. In general, alloys or solders of various and greater degrees of fusibility than the metals to be joined are placed between them, and the solder, when fused, unites the three parts into a solid mass; less frequently the surfaces or edges are simply melted together with an additional portion of the same metal."

In applying solder, instructions state that "it is of importance that the edges to be united should be chemically clean, and as in this state they have a strong affinity for oxygen, they are protected from the air by means of some flux. The usual fluxes are borax, sal-ammoniac, chloride of zinc, &c. A good liquor for tinning or soldering can be prepared from a mixture of chloride of zinc and muriate of ammonia, as follows. Dissolve 3 oz. of zinc in a pint of muriatic acid, letting it stand in a warm place about 8 hours. Strain the solution through a cotton or linen cloth, add a tea-spoonful of pulverised sal-ammoniac to a pint of the solution, and let it boil for ten minutes; when cool, it is fit for use."

**Soldier** (Latin, *soldarius*, one who serves for pay)—In the common acceptation of the term, a soldier is one who enlists to serve the government for certain pay and *privileges*. *He forms* one of a body for the protection of the country from outward invasion and for keeping down all internal dissensions; in short, protecting the interests of the country at home and abroad.

**Soldiers' Daughters' Home, Hampstead**—An institution founded March 8, 1855, for the maintenance and education, on the principles of the Church of England, of the daughters of soldiers, whether orphans or not. Every girl receives a supply of uniform clothing on admission, and an outfit of the value of nearly £8, including a Bible and prayer-book, when placed in service. Six hundred and sixty girls have been received into the asylum since its foundation, of whom 6 have been trained as schoolmistresses and assistant teachers, and 261 have been placed in service, and have generally done well; 138 rewards of £2 and £1 each have been distributed among the girls in service for 2 years' continuance in one place with certified good conduct. There are now in the home, where accommodation can be found for 200 girls, 170 girls, of whom 21 are supported by kind friends and by regiments, the remainder exclusively by the income of the home.

**Soldiery** — Soldiers collectively. A body of soldiers.

**Sole**—A veterinary term. That portion of a horse's foot which, together with the bars and frog, comes in direct contact with the ground.

In fortification, the term *sole* is given to the foot or bottom of the embrasure.

**Solid Shot**—Projectiles made of solid iron or steel. The only *solid* shot used in the service for rifled guns are the Palliser shot of the following calibres—12½-inch, 12-inch, 10-inch, 9-inch, 8-inch, and 7-inch, and they are only intended to be used against iron-clad vessels.

**Sollerets**—In ancient armour, the overlapping plates which formed the shoe of an armed knight.

**Solution** (Latin, *solutio*, from *solvo*, I loose)—The term "solution," in its widest sense, is applied to the perfect union of a fluid with another substance, no matter whether gaseous, liquid, or solid. But we call solution more properly *absorption* if the dissolved substance is *gaseous*; if *liquid*, the term *mixture* is more frequently made use of. The application of the term *solution*, in its usual and more restricted sense, is confined to the perfect union of a *solid* substance with a fluid.

**Solvent**—In chemistry, the liquid in which a solid is dissolved.

**Soondree** (*Heriteria minor*)—A wood used in India for the poles and shafts of carriages and the spokes of wheels. It is thus described by Conductor Skinner:—"The wood is strong, fibrous, and flexible, tolerably close- and straight-grained, not very durable, of a light red colour, turning to a reddish brown, and not easily worked. A cubic foot of unseasoned wood weighs 75 to 80 lbs."

**Soorkey**—Pounded brick dust; it is used in India for building purposes, and, in combination with lime, to make mortars, stucco, &c. It is well known to the Indian engineer. It has the property of making lime hydraulic, taking the place of the European pozzuolana and other hydraulic cements.

**Sortie**—A dash made by the besieged against the investing army to annoy the besiegers, retard their operations, destroy their works, and break through the investing line.

**Sound**—The sensation produced on the organ of hearing by the vibrations of the air or any other elastic medium, the equilibrium of which has been momentarily disturbed. Sounds are propagated to great distances and with remarkable distinctness over a surface of water or ice. It is stated that at the bombardment of Holmia, in Sweden, in 1658, the sound was heard 180 miles from the scene of action; and in the fight between England and Holland, in 1672, the report of the guns was heard at a distance of 200 miles. According to Russian accounts, the sound of the bombardment of Sebastopol was heard at a distance of 177 miles.

**Sound, Velocity of**—At the temperature of 33°, the mean velocity of sound is 1100 feet in a second. It is increased or diminished ½ foot for each degree of temperature above or below 33°.

**Sowar** (Persian = a rider, pronounced *suwār*)—A trooper of an Indian cavalry regiment.

**Space**—Room; the interval between troops when drawn up in line or column. In a battle, the amount of frontage which would be required for troops to act in. The 'Soldier's Pocket-book' lays down 1000 yards as a fair calculation for every 6000 or 8000 men of all arms. (*Vide* Frontage.)

**Spahi** (Persian, *sepāh-i*, a soldier)—A native cavalry man of Algeria in the pay of the French government. The regiments of *spahis*, of which there are three, are partly officered by French officers. A part of the Turkish cavalry is so called. In India, the native infantry regiments are called *sepahis* or *sepoys*.

**Spanner**—A screw wrench, used for the purpose of tightening nuts upon screws.

The spanner used in the field is "McMahon's 15." It has a fixed and a movable claw for use as a wrench. The movable claw can be set at any distance from the fixed claw by means of a thumbscrew.

**Spar**—A small beam. In bridging, spars are used for the building of light bridges, called spar and truss bridges.

**Spar Bridge**—A light bridge for crossing broken arches, rivers with steep banks, &c., in which it is not practicable or convenient to obtain supports for the bridge from the bottom or on the surface of the river. Works on military bridging give the following as the best known for spanning intervals with timber:—

*Single lever bridge.*—Composed of two frames locking into each other, and not meeting at a greater angle than 120°. This nature of bridge is not suitable for a greater span than 30 feet.

*Double lever bridge.*—Suitable for spans of 40 feet; it consists of two frames locking into a connecting frame or two or more longitudinal pieces, with cross transoms. The opening is thus divided into three spaces, and the span of the road bearers is about 14 feet.

*Single truss bridge.*—Can be used for spans up to 50 feet; it consists of two frames locking into each other in the same manner as the single lever bridge, and provides three points of supports, viz. one on each frame, and a third suspended by the ropes from the head of the frames.

*Lever truss bridge.*—Suitable for spans of about 50 feet; it is a combination of the single and truss bridges.

**Spars, Fishing,** *vide* Fishing Spars.

**Spatula**—A wooden slice or instrument; it should be used with great care in mixing inflammable or detonating compounds.

**Spavin** — A veterinary term. Any bony growth or bony enlargement in a horse, seen or felt in the inner side of the hough.

**Speaking Trumpet**—An instrument which, on being applied to the mouth, carries sound to a considerable distance. It was formerly used in large armies; and at the siege of Gibraltar, General Elliott (afterwards Lord Heathfield) caused the words of command to be given through a speaking trumpet.

**Spear**—A weapon having a wooden shaft mounted with a sharp steel point. It has been known and used from time immemorial, first as a hand or missile weapon, and subsequently as a pike or lance.

In the early Norman period, A.D. 1066–1087, the spear was a well-known military arm. It was sometimes ornamented, like the lance of the present day, with a small flag fixed just below the metal point, and termed, in the language of that day, *gonfanon* or *gonfalon* (*q. v.*).

**Specific Gravity,** *vide* Gravity, Specific.

**Spent**—A projectile is said to be spent when it reaches an object without sufficient force to pass through it, or otherwise to wound than by contusion.

**Spew, To**—In gunnery, to run at the mouth; applied to a gun when, from too quick firing, it bends at the chase, or the muzzle droops.

**Spherical Case Shot,** *vide* Shell.

**Spike**—An instrument in the form of a nail, made of steel, and used for rendering ordnance either temporary or permanently unserviceable. Spikes form a portion of the stores of a battery. They are of two kinds, *common* or *jagged* and *spring* (*q. v.*).

**Spike, Marline,** *vide* Marline Spike.

**Spike, To**—To choke up the vent of a piece of ordnance, so as to render it useless. The following is one of the modes and the readiest one, though not the most permanent. Take the *common spike*, which is 4 inches long, ·27 inch in diameter at the head, and about ·1 inch at the point, drive it as far as it will go into the vent, and *afterwards break* it off close to the gun. The next is the *spring* or temporary spike, which is ·17 inch in diameter, and has a flat head, to prevent its falling through the vent into the bore, and also a spring about 2 inches in length, which extends from the point towards the head. In passing through the vent, the spring is compressed, but as soon as it is clear of the metal it expands, and cannot be withdrawn, unless it is again compressed sufficiently to allow it to be drawn again into the vent. This however may be done by pressing the rammer head against it, provided the spring be towards the muzzle, which is known by a small notch cut in the head of the spike, to point out its direction. The point of a bayonet, or of a ramrod, or a common nail, will make a very good spike, if no spike is at hand. When spikes are not available, a gun may be rendered unserviceable by removing the cap-squares, elevating-screw, and any small support it is dependent on; or wrap a shot in a piece of cloth—a neckcloth or stocking will answer—and jam it hard home with a rammer.

**Spindle**—In moulding, this term is applied to the rod upon which the core of shells is formed. Also the wooden spindle upon which a gun mould is made. In mechanics, it denotes the axis of a wheel or roller.

**Spiral Bit,** *vide* Bit, Spiral.

**Spiral, Increasing,** *vide* Increasing Spiral.

**Spirals**—In geometry, are transcendental curves, which derive their name from making several revolutions round a fixed point, and receding at the same time continually from this point. There are various kinds of spirals, named according to their properties or their discoverers, and known as the *spiral of Archimedes*, *hyperbolic spiral*, *logarithmic spiral*, *parabolic spiral*, &c. In rifling a gun, the grooves made in it are termed *spiral* grooves.

**Spirit Level,** *vide* Level, Spirit.

**Spirit, Methylated,** *vide* Methylated Spirit.

**Spirit of Turpentine** — A spirit obtained by distillation from certain Coniferæ or trees of the fir tribe. It is known in commerce as turps or terps. The source of common turpentine is the

*Pinus sylvestris*, and its collection is an important branch of business in America. It is used in the ordnance department for mixing with paints.

**Spirits of Wine,** *vide* Alcohol.

**Splay**—In fortification, the widening of an embrasure towards the mouth.

**Splice, To**—To join the two ends of a rope together without a knot, or to unite the end of a rope to any part thereof, by interweaving the strands in a regular manner. The instrument used for the purpose is a marline spike. There are two kinds of splice, *short* and *long*, for making which the following instructions are given:—"To make a short splice, untwist from 4 to 8 inches of each of the two ends of the rope, and interlock the strands up to the close parts of the rope, those of the two ends alternating; hold in the left hand one end of the rope with the loose strands in front, and cross each strand of that end over the strand of the other end which is to the left hand of it; then by means of the marline spike pass it under the same strand of the second end, and draw firmly on the strand which is passed through. Pursue the same course with the strands of the second rope. To increase the strength of the splice, pass each strand round the one on its left a second time, and cut off the loose ends. The short splice is used for slings, block straps, or when the rope is not intended to pass through blocks. To make a long splice for a rope which is to pass through a pulley, the short splice being too thick, untwist about 8 inches of the two ends, and interlock as before, untwist a strand of one end from the close part of the rope and replace it by the strand of the other rope which comes to hand; cross the end of the latter strand over the one which is replaced, and pass it under the adjacent strands. Substitute, in this manner, every other strand of the other rope, and cut off the loose ends. The long splice is used to unite two ends of a rope which is to pass through a block."

**Splint**—In veterinary practice, is described as "a bony tumour on the inner and lower part of the knee-joint of a horse. The best treatment for this malady is conveyed in the old maxim, 'Time and patience.' Rest will do more than physic. To check the further enlargement of a splint, employ the following ointment:—

| | | oz. |
|---|---|---|
| Iodide of lead | .. .. | 1 |
| Simple ointment | .. .. | 8 |

Apply with friction, thrice a day."

**Splinter Bar**—The wooden bar of a limber which connects the futchels or framing pieces of the carriage with the axle-tree bed by means of iron stays at the ends. The traces of the wheel horses are attached to the splinter bar.

**Splinter Proof**—In fortification, a building strong enough to resist the splinters of bursting shells. To protect the gunners in a battery from the splinters of shells, *splinter proof traverses*, 6 feet thick at the bottom, are erected across the terre-plein, so that the effect of a shell bursting is confined to the space between two traverses.

**Splinters**—Fragments of exploded shells, wood, &c.

**Splints**—In ancient armour, the small overlapping plates for the defence of the bend of the arm; they constituted part of the suit called almaine-rivets, which was worn for the defence of the lower part of the body.

**Spoke**—A portion of a wheel, the tenon of which is fitted into the nave. In gun carriages, each wheel has twelve spokes, on the extremity of which the felloes are fastened, and which form one continued circle.

**Spokeshave**—A small iron plane something like a penknife, set in the middle of a frame, which can be used with both hands. It works easily in the direction of the grain, and is used for shaping and smoothing small rounded surfaces. This instrument is used by the carriage-maker, cooper, saddler, and other artisans.

**Sponge**—A porous marine substance, adhering to rocks, &c. This useful article comes from the shores of the Bahamas, from Greece, Tunis, Turkey, and other countries. It is of different qualities and texture, and is in very general use in the army, especially in the mounted branches for cleaning saddlery and harness.

**Sponge Buckets**—Buckets made of wood or leather, and used for cleaning or damping the sponges of siege and field guns. They hold water for washing the guns, watering the cattle, and other purposes connected with the cleanliness of the battery.

**Sponge Cloth**—A peculiar kind of cloth, moist with oil; it is used to clean the screws of Armstrong guns, and is made of cloth so woven that no fibre comes off in use by which the worms of the screws could be clogged.

**Sponge, Gun**—Consists of a rammer-head, staff, and sponge-head block. It is used for cleaning out a piece of ordnance after it has been discharged, or for freeing it of any lighted fragments of the cartridge. Sponges are of different dimensions and forms, according to the nature of ordnance with which they are used. The approved pattern head is cylindrical, except for the 11-inch M.L.R. gun of 25 tons, which is conical.

**Sponge Head**, *vide* Head, Sponge.

**Sponge, Washing**—A coarse kind of mop, made of oakum, jute, or old rope, lashed to a wooden stave. It is used for cleaning the bores of ordnance.

**Spontaneous Combustion**—Taking fire of itself. This phenomenon is known in the mineral and organic world. Frequently cases are stated of coals becoming ignited of their own accord. This is more often seen on board ships laden with coal, where, from the heat of the hold, and the moisture from water which a ship takes in from leakage, or other causes, the coal becomes heated and moistened, and from the conjunction of pyrites in the coal, in which the protosulphide is associated with the bisulphide of iron, it takes fire.

New-burnt charcoal, and particularly new ground charcoal, is very liable to spontaneous combustion. Phosphorus is another mineral subject which, in its dry state, is very liable to burn spontaneously. Articles of cotton or wool saturated with oil (vegetable), and heaped together, are very liable to burn spontaneously, oil having always an affinity for oxygen, and thus causing ignition. Many of the disasters that occur in powder-houses, when the houses have been closed and explosion has taken place, may possibly have occurred from *cotton-waste containing* oil *being left collected in a corner* of the *house.*

**Spontoon**—A long pike or lance; by some writers, a wide-bladed spear, which came into use in the reign of Henry VII. It is stated that the *spontoon*, in the shape of a pike or lance, was carried by officers in the British army about a century ago.

**Spring Spike**—In artillery, a spike with a spring attached to it, which is used for rendering a gun temporarily unserviceable. (*Vide* Spike, To.)

**Spring, To**—An expression made use of in firing a mine. There are various methods of springing a mine, either by Orde's mining hose, Bickford's fuze, &c.

**Spun Yarn**, *vide* Rope.

**Spur**—An instrument made of brass or steel, having a rowel with sharp points, and worn on the heel of the boot of a horseman. It is used for the purpose of quickening the pace of a horse. All cavalry, horse artillery, and staff officers, wear spurs; for the two former, they are made of steel, for the latter, of brass. In horsemanship, it is not desirable to use the spur more than can be helped.

In the days of chivalry the use of the spur denoted the knight. The saying, "to win his spurs," was for a young man to earn knighthood by gallant conduct, and to disgrace a knight was to deprive him of his spurs; and when one had had enough of him, that is to say, he had outstayed his welcome, the method pursued was to place a pair of spurs on a dish before him.

Anciently, the difference between the knight and esquire was that the knight wore gilt spurs and the esquire silver ones. The wearing of spurs dates back some centuries.

**Spur Wheel**—In machinery, a wheel which has the cogs or teeth on the edge or periphery, projecting radially from the centre.

**Spy** (French, *espion*)—A person sent into an enemy's camp to gain information as to the intentions of the enemy. The work committed to him should be carried out with great secrecy and without suspicion; if not done so, his life would be in great jeopardy.

Spies may be divided into two classes:—first, those who betray their own country to the enemy; secondly, those who, being enemies, are sent by their own party to obtain surreptitiously information about the opposing army. Notwithstanding this difference, that the first class are traitors, and the second are often brave men who dare much in the service of their country, martial law orders in both cases the death of a spy.

Spies are very necessary to an army, before and after hostilities have begun, as by making a proper use of these men, and by paying them well, the most secret designs of an enemy may be obtained, and the position his army is to take and hold at the time may be discovered, as well as his strength, &c. (*Vide* Intelligence Department.)

**Squad** (French, *escouade*)—A small portion of a company for purposes of interior economy. In the infantry it corresponds with a section. Also any small body of soldiers told off for drill or any particular duty.

**Squad Bags**—Canvas bags provided for troops (one for every 25 men), for the purpose of relieving a soldier from carrying a complete kit on the line of march or in the field. In India, where knapsacks are not carried by the soldier on the march, a small squad bag is issued to each soldier.

**Squadron** (French, *escadron*)—One of the main divisions of a cavalry regiment, consisting of two troops. It is the unit of cavalry tactics. A regiment in England has four squadrons; in India, only three. The strength of a squadron varies with that of the component troops, but it may be put down between 120 and 200 sabres.

**Square**—A tactical formation of troops, of which there are two kinds, the *solid* square, which faces outwards, having for its object to resist cavalry; and the *hollow* square, in which the men face inwards, for the purpose of hearing orders, &c. read, this being the most compact form in which all the men of a regiment can hear simultaneously.

The application of the *solid square* to resist cavalry appears to have been introduced in 1798, when the French army in Egypt, being weak in cavalry, was opposed to overwhelming hordes of Mamelukes. At the battles of Chebreifs and of the Pyramids, Buonaparte formed his infantry echeloned in squares against the Egyptian horse.

Since the introduction of arms of precision, the square is no longer considered as the formation absolutely necessary against attacks of cavalry; considering the annihilating effect of rifle fire, the infantry can now repulse, in every formation, a cavalry attack. The square formation has, however, been maintained in drill regulations.

The name *square* is given in carpentry to a steel blade, with the stock at right angles to it. This instrument is used by carpenters to ascertain, when pieces of wood have been planed, whether the surface and sides are at right angles to each other.

In geometry, a *square* is a four-sided rectilinear figure, of which all the angles are right angles, and all the sides equal.

**Square Root** — In mathematics, a number considered as the root of a second power or square number; or a number which, multiplied by itself, produces the given number. Thus 8 is the square root of 64; $\frac{1}{3}$ is the square root of $\frac{1}{9}$, and ·05 the square root of ·0025.

**Stables**—Shelter for horses or other cattle. In the inclement climate of England, cavalry horses should be covered in; only during service would they be picketed out in the open air. In India, stables are provided in all cantonments, though the horses often stand out where no stables are available, as they would have to do on service.

**Staff**—A body of officers appointed to assist a general, or any other officer in command, in carrying out his multifarious duties, and to form a link between him and the different branches of the army, thus giving coherence to all its parts.

The staff constitutes one of the most important parts of the organisation of modern armies, of which it is the life and soul. A general placed at the head of any considerable body of troops cannot at any time, and far less during war, carry out the minute details of his command. Such a task would be above the physical strength of any man, and would oblige that officer to lose sight of the *ensemble* of the forces under his orders. To help him to carry out his duties, aids are therefore appointed to assist him with their advice and knowledge in the special branches of the service to which they belong; such aids are called staff officers. Occasions often arise in which the commander of an army can only see, as it were, through the medium of their eyes, at a moment when circumstances require him promptly to decide upon difficult and critical operations.

The duties of the *general staff* in time of peace are, to prepare itself and the army for war; to keep up with the times in all matters connected with strategy, tactics, and organisation; to prepare beforehand outlines of all campaigns likely to occur in the future; to receive and digest information concerning foreign armies; and to take care that its own army is in no respect behindhand in efficiency. One of the most important branches, if not the most important, of the general staff is the intelligence department (*q. v.*). Officers attached to the staff of generals commanding *corps d'armée*, divisions, or districts, have to apply themselves to the study of questions on mobilisation, marches, manœuvres, and on the working of railways and telegraphs.

In time of war, the duties of the officers of the general staff are necessarily of a very laborious and active nature. They have:—

1. To draw up, according to circumstances, all orders relating to the cantoning of troops, outposts, marches, and battles. To give instructions to advanced and rear guards, and to make such arrangements as are required for the maintenance of order in the camps, as well as for their security.

2. To communicate in good time all necessary orders, either verbally or in writing; and to interpret the wishes and even give expansion to the intentions of the general in command.

It is laid down that, to avoid the possibility of being misunderstood, staff officers are directed to deliver all verbal orders entrusted to them in the plainest and most concise terms.

3. To collect and prepare all documents, maps, &c. concerning the theatre of war, as well as all information as to its resources.

4. To collect and digest the information concerning the *enemy brought in* by reconnoitring parties, spies, &c., and to communicate such information to superior authority.

5. To maintain the troops in such condition that they may always be ready to fight, and to be acquainted with their wants in every respect. To establish depots, magazines, hospitals, as well as convoys and means of transport.

6. To guide the head of each column to its destined position, either on the field of action or on the ground selected for encampment.

7. To keep a journal, noting therein all that is done during the day, especially on the march, battles, engagements, every change of position, the precise time at which each movement is carried into execution; in fact, every incident which is calculated to be of the slightest interest in its results; taking note at all times of the strength of every corps and of all casualties.

8. To fulfil special duties, especially reconnaissances (*q. v.*), in which the staff of an army takes a prominent share.

The duties of staff officers require, therefore, coolness, tact, quick ability, and reticence; they must be courteous in their communication with other officers of the army, and above all must have great confidence in their own judgment based upon experience.

The staff of the British army may be classed under three heads:—

1. General officers commanding divisions, districts, brigades, &c.

2. *General staff*, including the departments of the adjutant-general and quartermaster-general (*q. v.*).

3. *Personal staff*, consisting of military secretaries, assistant military secretaries, and aides-de-camp.

1. Appointments to commands are made from the list of superior officers of corresponding rank: those of brigades are usually given to colonels, with the rank of brigadier-general. They are assisted in their duties, and their orders are conveyed to the troops, by the staff.

2. *Officers of the general staff* are selected from the regular army, and must have passed through the Staff College, except in cases of proved abilities in the field. A chief of the staff (q. v.) is appointed to an army in the field, and

under his authority are the adjutant-general and the quartermaster-general.

3. *Personal staff officers* are not required to pass through the Staff College, but have to undergo a qualifying examination. They are appointed by the commander-in-chief on the recommendation of the general officer, holding their situation during his pleasure. No pay is allowed for such appointments unless authorised by the general's letter of service, or specially sanctioned by the Secretary of State for War. Extra aides-de-camp may, however, if absolutely necessary, in time of war or in cases of emergency, be appointed by a general officer in command, subject to approval by the War Office upon the recommendation of the commander-in-chief. These are not entitled to staff pay, but are granted the allowances of an aide-de-camp.

The general staff of the British army, appointed to relieve the commander-in-chief at the Horse Guards of the immense amount of detail work belonging to his office, is composed as follows:—

1 adjutant-general.
1 quartermaster-general.
1 deputy quartermaster-general.
3 deputy adjutants-general.
1 inspector of auxiliary forces.
2 deputy inspectors of auxiliary forces.
1 inspector-general of recruiting.
4 assistant adjutants-general and quartermasters-general.
4 deputy assistant adjutants-general and quartermasters-general.
1 director of topographical branch.
5 assistants of topographical and intelligence branches, with rank of deputy assistant quartermaster-general.
1 private secretary.
1 military secretary.
2 assistant military secretaries (one for Indian affairs).
6 aides-de-camp.
1 officer attached for duty.

In time of war the staff of an army differs in numbers according to the amount of troops in the field. By a recent order it has been classed as follows:—

*Army Corps.*

1 general commanding.
4 aides-de-camp.
2 deputy adjutants-general and quartermasters-general.
2 assistant adjutants-general and quartermasters-general.
2 deputy assistant adjutants-general and quartermasters-general.
1 commandant at head-quarters.
1 brigadier-general, R.A.
1 brigade-major, R.A.
1 aide-de-camp, R.A.
1 colonel commanding, R.E.
1 brigade-major, R.E.
1 aide-de-camp, R.E.
1 provost-marshal.
1 commissary-general.
1 principal medical officer.
1 chief staff veterinary surgeon.
1 principal chaplain.
12 staff clerks.

*Division.*

1 lieutenant-general commanding.
2 aides-de-camp.
2 assistant adjutants-general and quartermasters-general.
1 deputy assistant adjutant-general and quartermaster-general.
1 lieutenant-colonel, R.A.
1 adjutant, R.A.
1 lieutenant-colonel, R.E.
1 adjutant, R.E.
1 assistant commissary-general.
1 principal medical officer.
1 chaplain.
6 staff clerks.

*Cavalry and Infantry Brigades.*

1 major-general commanding.
1 brigade-major.
1 aide-de-camp.
1 commissary.
1 staff clerk.

The word *staff* is also applied to certain officers attached to the various civil departments (*q. v.*) and regiments, to carry out certain duties in subordination to superior authority. Such are the *medical* and *regimental staffs.*

The regimental staff is formed of the adjutant, the instructor of musketry, the quartermaster, the paymaster, the surgeon, the quartermaster sergeant, &c.

**Staff College**—In the British army, the school of instruction for officers at Sandhurst who wish to be placed on the staff of the army, or who wish to improve themselves in the knowledge of their profession. It was founded in 1858. (*Vide* Appendix A.)

**Staff Corps**—Formerly an organised regiment of officers, many of whom served under the Duke of Wellington on the staff. After the close of the Peninsular War, the corps died out. The staff corps, as now known under that name, is that in India, which is formed into three corps, one in each presidency, and which was raised after the mutiny of 1857–58. The corps are made up chiefly of officers of cavalry and infantry of the late Indian army, and vacancies are filled up by young officers from her Majesty's European regiments.

**Staff Pay**—Pay given to officers and soldiers in the government service, who perform duties either on the permanent staff of an army or in regimental or departmental employment. (*Vide* Appendix O.)

**Staff Sergeants** — Non-commissioned officers employed on the staff of a regiment, district, or division. The following are classed under the above head:—

Master gunner.
Sergeant-major.
Schoolmaster.
Bandmaster.
Quartermaster sergeant.
Sergeant instructor of musketry.
Sergeant instructor in fencing and gymnastics.
Sergeant assistant instructor of gunnery.
Farrier-major.
Drum, trumpet, pipe, or bugle-major.
Paymaster sergeant.
Orderly-room sergeant.
Armourer sergeant.
Hospital sergeant.
Saddler sergeant.
Collarmaker-major.
Wheeler-major.

The above staff sergeants are entitled to lodging, fuel, and light allowance when there is no barrack accommodation. (*Vide* Addenda, Allowance.)

**Staggers**—A complaint with which horses are sometimes attacked; termed also vertigo. A kind of giddiness.

**Stakes**—Small pieces of wood, either formed by hand or cut from the small branches of abatis. They are used as an obstacle against the advance of an attacking force, being sharply pointed and driven into the ground until only 1 foot or 2 feet project. They should be placed either in front of the counterscarp or in the ditch.

**Stampede**—Terror and confusion among flying troops, horses, &c.

**Stand of Arms** — A single rifle or musket with bayonet complete.

**Stand, To**—To refuse to give way or yield. Thus, *to stand the enemy's fire* means to remain with firmness, in an orderly array, without giving way to the withering fire of the enemy. *To stand under arms* means to be ready for action.

**Standard**—A flag or banner. Standards are carried by heavy cavalry regiments only. The *royal standard*, or colour, in the guards is never to be carried by any guard but that which attends on the person of the sovereign. In certain forts or garrisons, the royal standard is hoisted on royal anniversaries and state occasions.

**Standing Camps**, *vide* Encampment.

**Standing End**—The fixed end of the fall of a tackle.

**Staple**—A loop of iron which passes through the opening in the hasp, and to which the padlock is attached.

**Star**—In military life, a star is an order (*q. v.*), or decoration, also a mark of rank, worn by officers on the collar of the regimental coat, sometimes alone, and sometimes in conjunction with the badge of the crown, according to the rank of the officer.

In astronomy, the general name for all the heavenly bodies. Stars are distinguished as *fixed* and *wandering;* the former are those which have usually been observed to keep the same distance with regard to each other, the latter to change their places and distances, and are distinguished by their particular names of *planets*, *comets*, *satellites*, &c.

**Star Forts** — Fieldworks proposed to remedy the defects of redoubts which have the ground before their angles undefended by a flanking fire. By this tracing a cross fire is brought upon the ground before the angles, but, in consequence of the great exterior slopes necessarily given to field profiles, the lengths of the faces are greatly diminished, affording but a feeble quantity of fire from each; and for the ditches, the flanking defence amounts to nothing.

Baron Jomini says that "star forts are the very worst description of fortification. They cannot have flanks, and the re-entering angles take so much room from the interior space that there is no room for troops or artillery."

**Star Gauge,** *vide* Gauge, Star.

**Star of India**—An order instituted by her Majesty Queen Victoria, in 1861, for the purpose of rewarding officers, civil or military, native princes, and others who have rendered important service to the crown in India. There are three classes of the order: knights grand cross, knights commanders, and companions. The insignia consist of the collar, composed of the heraldic rose of England, two palm branches, in saltire, tied with a riband, and the lotus flower, alternately connected together by a double gold chain. In the centre is the imperial crown, from which is depended the badge, consisting of a mullet set with brilliants, over an oval medallion containing an onyx cameo bust of the Queen, surrounded by the motto of the order, "Heaven's light our guide."

**Star Shell,** *vide* Shell.

**Staring Coat**—Applied to the skin or coat of a horse the hairs of which stand erect. This appearance is produced either from bad care of the animal or happens at the change of the season when winter sets in.

**Stars**—In pyrotechny, the decorations of rockets which are observed when the head of the rocket explodes. (*Vide* Fireworks.)

**Statics** — In mechanics, the science which considers the weight of bodies, or the motion of bodies arising from gravity.

**Station, Military**—A locality chosen for the garrisoning of troops.

**Status quo** (Latin = the state in which) —The position of two or more belligerents towards each other, after having entered into a treaty by which they remain as they were before hostilities broke out with regard to their territories, fortresses, &c.

**Staves**—Long narrow pieces of wood, which, when braced together, form the sides of casks or powder barrels. In England, powder barrels are usually made of American oak; in India, of teak.

***Stay-irons***—In artillery carriages, the iron rods which connect the ends of the axle-bed to the splinter-bar.

**Steam**—Water expanded into an aëriform state by the addition of heat. Water boils at 212°, and at that point gives off vapour or steam.

**Steam, Expansive,** *vide* Expansive Steam.

**Steam-engine**—The following description is taken from Weale's series:—

"A machine for deriving power from the expansion which results from the conversion of water into vapour or steam by the application of heat. This expansion is so great that a given quantity of water becomes, when changed into the form of steam, enlarged to about 1728 times its original bulk; and this expansion takes place with a force that may be termed irresistible. Thus, if water be enclosed in a vessel, say of iron or any other strong material, and the water be expanded into steam, and insufficient space left for the expansion, the vessel will be burst by the force of the steam within. A steam-engine consists essentially of a vessel into which the steam is admitted, and which is provided with a movable disc, closely fitting the interior and capable of sliding within the vessel. This vessel is made cylindrical, because this form gives the greatest strength, and is the most readily fitted with the movable disc. The vessel is termed the *cylinder*, and the disc the *piston*. Supposing the cylinder to be placed upright and fitted with a close cover, and that, while the piston is near the bottom of it, steam is admitted to rush in through a pipe below the piston, the piston will be driven up by the steam, and if, when it reaches the upper part of the cylinder, the steam from below is shut off, and admitted through an upper pipe to press upon the top surface of the piston, it will be forced down again. Thus a rectilinear motion up and down is produced, and this constitutes what is called the *principle* of the steam-engine. All its other parts are for the purpose of regulating the admission of the steam, and converting the rectilinear motion produced by the cylinder into a rotary motion at the point where the power is required to be applied for working machinery. The steam, when no longer required for that purpose, is allowed to escape into the open atmosphere, or conducted in a pipe to another vessel, which, being cooled by the application of cold water, rapidly condenses the steam—that is, reconverts it into water. If permitted to escape into the air, the steam has to force itself against the pressure of the atmosphere, whereas, if conducted into a condenser, this force is not required. Hence steam of less pressure will work what is termed a *low-pressure* or *condensing engine*, while that already described is for distinction called a *high-pressure engine.* A third variety of steam-engine is worked by shutting off the steam before it has driven the piston the whole length of the cylinder, or completed the *stroke*, as it is termed, and the subsequent expansion of the steam completes the impulse upon the piston. Engines thus worked are distinguished as *expansive engines.* The principal difference in the mechanism of condensing and expansive steam-engines is in the movement of the apparatus which admits and shuts off the steam, or the *valves*, which act as doors within the pipes. The several parts of a condensing engine and its appliances are as follows:—Firstly, the *boiler*, in which the steam is produced from water by the action of fire in the furnace beneath; secondly, the *steam-pipe*, in which the steam is conveyed to the engine; thirdly, the *steam-chest*, in which the steam is received, and which communicates with the two *induction-pipes* that lead into the upper and lower part of the cylinder; fourthly, the *cylinder* fitted with the *piston*, and having pipes called the *eduction-pipes*, through which the steam passes away, when its work in the cylinder is completed, into the condenser; fifthly, the *air-pump*, which abstracts the water formed by the condensed steam, sending it into the boiler, producing a partial vacuum within the condenser, and thus assisting the escape of the steam from the cylinder; sixthly, the *condenser* itself, which is kept cool with water pumped up by the cold-water pump. The piston has a rod fixed to it, which works through a steam-tight opening or *stuffing-box* in the lid of the cylinder, and this *piston-rod* is attached to one end of a *beam*, which turns upon a centre, and the *other* end of which works a *connecting-rod* attached to a *crank*, to the side of which a rotary motion is thus imparted. In some engines the piston-rod is connected by links directly with the crank, and these are hence termed *direct-action* steam-engines, while the former are distinguished as *beam engines.* In others, again, the piston-rod is attached to the crank without links, and the cylinder, instead of being fixed, is made to vibrate or oscillate: these are therefore termed *vibrating* or *oscillating engines. Marine engines*, for propelling vessels on the water, and *locomotive engines*, for propelling trains of carriages upon railways, are each distinguished by peculiarities of construction and arrangements fitting them for their especial duties."

**Steam-gauge,** *vide* Gauge, Steam.

**Steam-hammer** — Besides the usual form of steam-hammer, as described under Hammer, Steam, there is the double-acting steam-hammer, in which the steam power is used not only to raise the block but also to drive it down upon the forging. In this hammer the steam cylinder is fixed, and the falling weight is attached to the piston-rod. This hammer is used in the Royal Gun Factories, and also smaller ones constructed after Condie's patent, in which the piston is stationary, and the cylinder moves, the hammer being attached to the bottom of the cylinder; and the piston-rod, which is a stationary cylindrical pipe, serves to convey the steam to and from the cylinder. In all modern hammers, the steam presses the hammer down as well as raises it up.

**Steel** (German, *Stahl*) — This widely known and useful metal is a compound of iron and carbon, in the proportion of the latter, for ordinary purposes, of 1·5 or 2 per cent.

Mr. Anderson, C.E., who was a few years ago assistant superintendent in the Royal Gun Factories, Woolwich, gave an admirable description of iron and steel, in the manufacture of ordnance, in a lecture at the Royal United Service Institution, in 1862, an extract of which, relating to steel, it is considered worth while inserting:—

"The material called steel is an intermediate compound between cast iron and the former material of wrought iron. Steel is comparatively a pure iron, containing a small percentage of carbon, with some other substance in combination, which is rather obscure, and regarding which there is considerable difference of opinion. This combination gives the material, which is entirely different in character from either of the metals out of which it is made, some very peculiar characteristics of its own. Steel can either be made from wrought iron or from cast iron. The latter arrangement is the cheapest process, but the former method affords the most certain results at the present time, and that is the system chiefly resorted to in making the finer qualities of steel. To make good steel of high quality, a bar of pure wrought iron is selected, mostly Swedish, which has been made with charcoal in all its previous stages. The iron bars are put into a fire-brick chest along with a quantity of charcoal powder; every part of the bar being surrounded with the carbon, the air being excluded, the whole is made white-hot, and kept in that condition for several days, generally about a week, according to the amount of conversion that is required. During this period the pure white-hot iron imbibes a new property from the charcoal into its own nature. A chemical action takes place, and the wrought iron has been thus gradually turned into steel. Such steel, however, is very imperfect. The defects are chiefly owing to its local irregularities of conversion, for although the entire mass of the bar may have had the proper quantity of carbon put into it, yet it is found to be much improved through mixing the particles, either by welding several bars together into one bar, or even the mere working of a single bar under the hammer has the effect of equalising and greatly improving the quality. The most effectual way, however, of obtaining a thorough mixture of the particles is to break the original steel bars into small pieces, then to melt them together in a crucible into liquid steel, and then to mix and pour this metal into an ingot, which, when solid, is then drawn into a bar of steel of the required dimensions. By this means of putting carbon into pure iron, cast steel is produced, which is the finest in quality of any of the varieties of this valuable metal. But good passable steel can be made directly from cast iron, simply by not carrying the puddling process on to the full extent of wrought iron. Such material is called *puddled steel*, and although at the present time it is not equal in quality to that which is made in the other way, still it is very much cheaper, and when more experience has been gained so as to determine the best descriptions of cast iron that are suitable for this particular process, as also the precise period when to discontinue the puddling operation, so as to leave the proper quantity of carbon in the metal, there can be no doubt but that such cheap steel will be extremely valuable for many purposes, seeing that puddled steel is malleable, and has even a higher tenacity than wrought iron. A very fine material is now produced extensively by breaking up the rough bars of puddled steel and melting them into a cast steel, which, for many purposes, is found equal to ordinary cast steel as made from Swedish iron; so far as I am aware, however, it is not so good for edge tools.

"Good steel can be made in a still more summary manner by means of the 'Bessemer process.' The crude cast iron, when in a melted state, is poured into a large refractory vessel heated, and a strong blast of air is forced through the fluid, producing a violent agitation; the silicium and carbon in the iron unite with the oxygen in the air, and are driven off from the metal, until the remaining mass is almost pure wrought iron. There is then added to the iron (in order to make it steel) a definite quantity of carbon; it is introduced in the condition of liquid cast iron of known mixture and quality; the whole is then thoroughly mixed, and the entire process is completed in about half an hour from the time of first pouring in the cast iron to the final running out of the steel into moulds or ingots. By the 'Bessemer process' large masses of steel can be made more easily than by any other method yet introduced, and apparently at less cost, and there is no doubt that in time this process will produce uniform quality.

"Steel in all its combinations is a most valuable metal; in its ordinary state, it is closer in structure, has greater power of resisting compression, and possesses a higher tenacity than wrought iron even of the best quality, and as such it commends itself to the engineer for the manufacture of the best class of articles, notwithstanding its greater cost, and the still greater expense which has to be incurred in its fabrication into the requisite forms. But it has another property which causes it to transcend in value all other metals, namely, the capability of being tempered to any degree of hardness or softness. The discovery of the fact that a piece of soft steel, when heated, and then suddenly cooled, no matter by what means, assumes a hardness approaching that of the diamond, is perhaps the most important of any in connection with the whole range of metals, and has been of the greatest service to mankind. In addition to this property of hardening, when the said hard substance is exposed to a. gentle heat, it gradually begins to give off a portion of its hardness, until at length it loses it altogether, and as it so happens that at the same time that the hardness is gradually departing, a definite change of colour of the surface of the steel accompanies the softening process, this change of hue becomes a correct measure of the change in hardness, and thus the precise degree of hardness or temper that may be required for any purpose can be attained with great certainty and uniformity. Steel, wrought iron, and cast iron can all be rendered softer and less brittle by means of the annealing process, which is simply causing the materials to be made red-hot, then keeping them in that state for a short time, and afterwards allowing the whole to cool down very slowly, so that every part may cool at a uniform rate, and no part or particle be under any restraint from premature withdrawal of heat, thus causing local contraction and hardness. By prolonging the period of cooling, a mass of steel comparatively brittle acquires the character of toughness in a remarkable degree, and this *process of annealing* now plays an important part in all modern efforts to use steel either for guns or armour plates, or for anything exposed to jar or sudden vibration."

The latest improvement in the preparation of steel is the process pursued by Sir Joseph Whitworth in condensing the metal in a fluid state, whereby the chance of air bubbles is obviated, thus rendering the steel very much stronger, and doing away altogether with the complaint formerly made of its brittleness for guns.

The metal with which the Krupp guns are made is stated to be a mixture of steel and wrought iron, melted in crucibles made, with great care, of fire-clay, to which a little plumbago is added, or wholly of that metal, and holding about 30 lbs. each. The ore employed is received from two sources, one, furnishing the well-known *Spiegeleisen*, a highly crystalline variety, containing about 4 per cent. of manganese, the other partly red iron ore, both smelted with coke. The puddling process for steel is similar to that employed for iron, except that the former is conducted at a lower temperature, and requires nicer management; but in the case of steel the cast iron to be operated upon is never refined. In order to free the puddled steel from a certain intermixture of cinder, and to give it homogeneity, it is remelted into crucibles, when it becomes converted into cast steel. On leaving the furnace, the metal is kept flowing in a continuous stream into a reservoir, and from that into moulds, great care being taken in timing the movements of that operation. The cast is then allowed to cool till it has shrunk sufficiently from the mould to be turned out, when it is surrounded by hot cinders and kept hot till wanted for forging. In order to increase the density, strength, and elasticity, as well as for the sake of homogeneity, all castings are made cylindrical or square, and hammered to the rough shape required. Whilst being hammered, the ingot is kept at the same temperature by frequently heating it, and when fully worked, the breaking strain of the metal is about 44 tons per square inch.

The essential difference between steel, wrought iron, and cast iron, consists in the proportion of carbon present in each, which is as follows :—

| | | |
|---|---|---|
| Wrought iron | 0·1 to 0·3 | per cent. by weight. |
| Steel .. .. | 0·3 to 2 | " " |
| Cast iron .. | 2 to 5 | " " |

Krupp's steel is stated to contain from 0·5 to 1 per cent. of carbon.

**Steel, Blistered,** *vide* Blistered Steel.

**Steel, Cast,** *vide* Cast Steel.

**Steel, Firth's**—The steel used in the manufacture of the tube of British rifled guns. Its tensile strength is about 30 tons untempered (about 50 tons when tempered), and its elastic limit about 13 tons, Krupp's gun steel being over 30 tons in tensile strength and about 6 tons in elasticity.

**Steel Guns**—As the name implies, are guns made of steel. In the British artillery, guns entirely made of that metal have not been adopted, except for one nature of mountain gun. The M.L.R. guns of the service have the inner barrel made of steel. (*Vide* Woolwich Gun.)

The mountain gun above alluded to (7-pr.) is made from a solid block of steel, rough bored and shaped, then toughened in oil, and afterwards finished in the usual manner. The bore is 3 inches, and rifled with three grooves on the French system, having a twist of one turn in 20 calibres. This rifling differs from the modified French system (as applied to the 9-pr. and 16-pr.) in not having the corners rounded, and in the curve of the bottom of the groove being described concentric to the bore. The grooves are 0·6 inch wide at the bottom and 0·1 inch deep. (*Vide* Appendix B.)

Since the introduction of rifled ordnance in Europe and America, special attention has been directed to steel as a material capable of withstanding the immense strain to which rifled guns are subjected; but English artillerists found an objection to this metal chiefly on account of its brittleness and want of endurance, the trials made with steel guns in this country and on the continent, some years ago, not having been considered satisfactory.

The want of confidence in steel guns arose probably from the fear that manufacturers had not yet attained to the perfect method of forming the gun or the want of knowledge in the manufacture of the metal itself; but the system lately pursued by Sir J. Whitworth, of compressing steel in its fluid state by hydraulic pressure, has produced guns which afford all the endurance and strength that can be desired. In the compression of this metal, all cavities or air cells are driven out, and it becomes perfectly homogeneous. Steel possesses important advantages over wrought iron, such as elasticity, tenacity, and hardness, but it is more expensive.

Steel, as a metal for the manufacture of ordnance, has been adopted by most continental nations, the chief manufacturer being Mr. Krupp, of Essen, in Prussia, whose guns have been adopted not only by Germany, but also by Russia, Belgium, Holland, Italy, Spain, Egypt, Turkey, and even Japan. Austria, for a time, carried on experiments with some of Krupp's guns with the view of introducing them into her service; but preference has since been given to steel-bronze (*q. v.*), which is stated from experiments to be superior to steel.

Krupp's guns of a small calibre are manufactured from one solid block; those above 8-inch calibre are compound, being weighted and strengthened by external rings in the manner described under the head of Krupp Guns.

The uncertainty of some of Krupp's heavy guns was shown some years ago, particularly in the trials made in Russia. Two burst after firing a comparatively few number of rounds, one 66, the other 109 rounds; the former is stated to have burst from the jamming of the shot; the latter, it is inferred, from defective metal, though the contrary is reported. Four guns were then tested for endurance; two of which, M.L.R. guns, withstood, the one, 215, the other 286 rounds. The other two were S.B. guns, and withstood 1025 and 790 rounds respectively. None of them burst, but they were all worn and eaten into the seat of the shot, by gas, to such an extent that the committee considered that the service of the rifled guns could not with safety be assigned a higher duration than 250 rounds. An 11-inch cast-steel Krupp gun, tried in 1871 at Cronstadt, burst at the muzzle after the ninth shot, this result being probably due, in the opinion of the committee, to a flaw in the metal near the muzzle. During the war of 1870–71, many of Krupp's light guns are stated to have become unserviceable, but probably they became so, not so much from any fault in the metal, as from some mechanical derangement in the breech-loading apparatus, which has doubtless since been remedied. The Krupp guns lately manufactured for the German army appear from the reports to be very satisfactory.

Such are a few of the principal results attained in the manufacture of the early steel ordnance. Whether guns of this metal will eventually be introduced into the British service, it is difficult to say; as far as can at present be seen, no change is likely to be made. Another drawback, besides the uncertainty of the metal resisting the strain of the charge, is the great cost involved in melting and casting the material, together with the expense of turning and boring such a hard metal, all which add greatly to the price of the gun.

The relative cost of steel guns compared with those of pieces manufactured of other materials has been computed as follows:—

| | Per ton. |
|---|---|
| Cast-iron guns .. .. .. .. | £21 |
| Armstrong (original construction), wrought iron with steel tube .. .. .. .. .. | 100 |
| Armstrong (Fraser construction) .. .. .. .. .. .. | 65 |
| Steel, on Krupp's or Whitworth's plan .. .. .. | 170 |
| Gun-metal .. .. .. .. .. | 190 |

Russia has large steel factories at Aboukoffsky and at Oberchoff. In England, the Sheffield Works and the Vavasseur Factory in London manufacture steel guns.

**Steel-bronze** (German, *Stahlbronze*)—An alloy of tin and copper, so hardened as to render it as durable and strong as steel; hence its name. The mode of treating this alloy is the invention of a Frenchman, M. Lavessière. It has been of late improved on by General Uchatius, director of the royal arsenal at Vienna, and employed by him in the manufacture of light field guns.* It takes its name, not from any steel entering into its composition, but is simply given to signify that the metal possesses, as is shown above, the properties of steel, so as to qualify it as a substitute for that metal in gun-making. It is also alleged that there is no phosphorus in it.

The composition of steel-bronze differs only slightly from that of ordinary bronze (90 per cent. of copper and 10 per cent. of tin), the alloy consisting of 92 per cent. of copper and 8 per cent. of tin. The great secret of producing this metal lies in the manner it is cast, and this comprises two operations, viz.: (1) casting in an iron mould, around a metallic core; and (2) passing the metal, when cold, through the rolling mill.

The moulds are of cast iron, and 3·9 inches thick; in the centre of each is placed a wrought copper core, 1·9 inches in diameter, around which the metal is cast and chilled.

**Steel-bronze Gun**—A gun lately introduced into the Austrian service, and made of steel-bronze.

The mode of manufacture is as follows. The metal having been prepared as shown above, the cylinders are bored to a diameter smaller than that required for the bore of the gun. For this purpose the cylinders are placed vertically on a support, then steel punches or cones are forced into the aperture by means of a powerful hydraulic press. The size of these cones increases gradually, so as to produce a progressive widening of the inside of the bore; six cones are sufficient to alter a diameter of 3·15 inches into one of 3·425 inches. In the formation of the gun in the process adopted, the surface of the bore acquires a hardness equal to that of steel, and the strain given by the distension of the interior is far greater than can be given to the powder chamber on the explosion of the greatest charge it can be made to hold. General Uchatius states in his report the reasons that led him to adopt the above process, in the following words:—

"The work done by the powder to the detriment of the gun at the commencement of the shooting, namely, the enlargement of the bore, must be exerted by mechanical pressure beforehand, and to a still greater degree than the work done by the strongest occurring powder-gas pressure, whereby the elastic power of resistance of the barrel will be so increased that the subsequent smaller powder-gas pressures will exert no further effect, and the metal immediately surrounding the surface of the bore must be given the necessary degree of hardness by subjecting it to a process analogous to that of rolling out."

---

* It has not yet been decided whether steel-bronze is applicable to *heavy ordnance.*

Thus is repeated what is done in the manufacture of the Macomber gun (*q. v.*), with this difference, that that gun is "built up" of wrought-iron discs, "set" by means of a powerful hammer, and the breech encircled with heavy steel rings.

General Uchatius further says of his gun:—"All metal strata surrounding the bore concentrically are in a state of elastic tension, and exert a pressure, from without inwards, equal to the pressure exerted by the hydraulic press ramming from within outwards, and which the table of pressures shows to correspond very nearly with a state of about 2400 atmospheres."

The experiments made with these new guns have shown that the *bronze-steel*, as it is also called, is not only as hard as cast steel, but far more elastic, and the action of the powder-gas seems to injure the gun very little; further, it is less liable to damage from atmospheric action than steel. The initial velocity is very little less than that of the Krupp gun, and to these advantages must be added the great difference in price (cost of construction), which is stated to be only £35 per gun.

The dimensions of this new gun are the same as the Krupp gun (*q. v.*) of 8·7 centimetres, from which it was copied, the only difference being in the length of the bore, which is 6 feet 5 inches. The wedge and the vent bush are also slightly different; the bore is provided with a copper Broadwell ring, and closed with a flat wedge of Uchatius' construction; the vent bush is bored in a copper screw, and is perpendicular to the axis of the bore.

The Austrian committee of artillery, after the late experiments with the steel-bronze gun, reported as follows:—"The steel-bronze B.L.R. gun, throwing a projectile of about 14 lbs., with a charge *of 3·3 lbs.*, showed great durability; *after 2147* rounds had been fired from it almost without interruption, the melting of the tin particles was considerably less than the burning out of the breech surface of the Krupp gun of the same calibre that was tried along with it; and, besides, the erosion did not exceed the admissible limits.

"The comparative firing showed that the steel-bronze gun possesses the same accuracy as that of the cast-steel gun. Notwithstanding the melting of the tin particles, the accuracy of the firing was in no way diminished, and the projectile that was purposely allowed to burst in the bore after 2121 rounds damaged the parts but little where the explosion took place, and even then, the firing was not inferior to what had taken place. The extreme durability of the bore is due not only to the excellence of the material, but also to the construction of the loading chamber, as well as to the construction of the projectile. The projectiles used in the trial were of two kinds: a common shell and a bolt-shaped shell, with double case, of 2½ calibres in length, with four belts of copper wire or guide-ring encased in its cylindrical portion."

Competent artillerists in Germany, it is stated, have shown themselves favourable to the steel-bronze, and the committee of artillery at Berlin has caused two pieces of this metal to be manufactured for the purpose of carrying out experiments. If these give good results, it is proposed to employ steel-bronze in the manufacture of garrison and naval guns, and thus utilise the large stock of bronze ordnance possessed by the German artillery.

**Steelyard, or Roman Balance**—A balance by means of which the weights of bodies are ascertained by a single standard weight. The steelyard is a lever having unequal arms; on the shorter arm the body to be weighed is placed, and on the longer the standard weight is placed, which moves backwards and forwards on the arm until it touches a point which counterpoises the body being weighed. Divisions graduated on the longer arm indicate the weight of the body weighed.

**Stencilling**—A method of producing the picture of an object without drawing it. It consists in simply tracing out on paper, or on some other substance, such as thin leather or oil-cloth, the objects which it is desirous to delineate on some smooth surface. The object having been traced, the parts to be delineated are cut out, and the vacant spaces rubbed over with colour on the wall or surface to be painted; on raising the paper, the picture will be observed below. Stencilling is much used in decorating the walls of rooms, and also largely in factories where there is much marking, the address being cut out on thin metal, and then rubbed over with paint. It saves much labour and expense. Powder and other barrels are so marked.

**Step**—A pace; progression made in walking by the removal of the foot. Hence *to step out* means to lengthen the pace, or to march quicker; *to step back*, to take one pace to the rear.

*Quick step.*—A military step of 30 inches, with a cadence (number of steps per minute) of 116 per minute, in the British army. It constitutes what is technically called *quick time* in marching. At that rate, a small body of troops can march 3·1 miles an hour without halting, but it would be better to calculate the rate of marching for infantry at 2¾ miles an hour.

In the German army, the quick step is 31½ inches, with a cadence of 112 per minute; in the Austrian 29½ inches, with a cadence of 115 to 130 per minute; in the Italian, 29½ inches, with a cadence of 120 per minute. In the French army it was increased, in 1875, from 25½ inches to 29½ inches, and the cadence raised from 111 to 115 per minute.

*Step* is figuratively used to signify promotion; thus, the step from a lieutenant to a captain, and so on to higher grades.

**Step Over, To**—To rise above another; to receive promotion over another officer or soldier.

**Sterro Metal**—A species of brass consisting of copper 60, zinc 44, iron 4, tin 2. It is said to be the invention of Baron von Rosthorn, of Vienna. It derives its name from a Greek word signifying "firm." It has a brass yellow colour, is close in grain, is free from porosity, and has considerable hardness, whereby it is well adapted for bearing metal, or other purposes where resistance to friction is needed. Its tensile strength is nearly double that of bronze, but it is difficult to secure uniformity in the casting.

Sterro metal possesses another quality, which, in reference to its application to guns, would be regarded as more important than its tenacity—namely, its great elasticity; but it has never been used for guns.

**Stick, Gold**—A name or position accorded to the colonels of the two regiments of life guards, whose duty it is to be present in immediate attendance on the sovereign on all state occasions. These officers take the duty in turn, monthly. The officer on duty is called the *gold stick in waiting.* It is stated that the name originated in the sovereign giving the colonel of the life guards a gold stick on his receiving the regiment.

**Stick, Silver**—The field officer of the life guards, when on duty, is called *silver stick.*

**Still** (Latin, *stillo*, I drop)—Maunder describes it as "a chemical apparatus for vapourising compound fluids, and recondensing the vapours of each of the component parts as they are successively raised by heat. It consists of a body or boiler, a worm, a refrigerator, and a receiver."

**Stirrup**—An iron hoop fastened to the saddle by a leather strap, to enable the rider to mount and dismount, and support his foot while in the saddle. The present pattern stirrups are similar to those attached to a hunting-saddle. The stirrup irons are made of shear steel. The lance stirrup has a leather bucket attached to it, for the butt of the lance.

**Stock**—The nave of a wooden wheel; the handle of a tool. The whole of the wooden part of a rifle, pistol, &c. is termed the *stock;* it is generally made of walnut wood.

**Stock with Taps and Dies**—Tools used in workshops. The dies and taps are made of cast steel; the former for cutting screws or bolts, the latter for internal screws, as in nuts; they are of three sizes, large, medium, and small. A set of either size comprises a stock, 3 dies of sizes, 9 taps, or 3 to each die; named entering, second, and full tap, and a wrench.

**Stockade**—A solid barricade of timber, for intrenchments or redoubts, 8 or 9 feet high, or even more, with a loopholed arrangement for musketry fire. In some stockades each man has a trap-hole in the banquette in rear, into which he disappears after discharging his musket. The Burmese and Malays resort very much to this mode of defence. It is found to be the usual protection of native villages among wild and forest tribes who have wood at their command. The best way to destroy a stockade is to blow it up either with powder bags or with gun-cotton. Shot or shell of the largest nature make very little impression upon this class of defence. (*Vide* Bags, Gunpowder.)

**Stoking**—The operation of feeding a furnace with coal. It requires great attention, skill, and experience. It may often happen that two stokers do not stoke alike, the bad stoker burning more coal, at the same time keeping up less steam. The secret in stoking is this, that the coal should be broken up into small pieces, and, when thrown on the furnace, should be so placed as to cover the whole surface of the grate, and prevent cold air from coming up between the bars into the furnace, which would reduce the temperature, and consequently the amount of steam. In locomotives the coal should be thrown on a little at a time.

**Stone**—A weight of 14 lbs. A mounted cavalry man, with his appointments, weighs from 17 to 19 stone, depending on the nature of cavalry. This is the total weight the horse has to carry.

**Stone Coal**—Another name for anthracite coal (*q. v.*). South Wales abounds in this nature of coal.

**Stone, Oil**—For sharpening tools, such as chisels, planes, &c. It is also called *Turkey stone.*

**Stone Shot** — Used with guns up to the sixteenth century. The class of ordnance from which they were discharged was comparatively weak as compared with that of the present day, and consequently the projectiles were of no great size. Stone shot were also discharged from mortars. (*Vide* Pierrier.)

**Stool-bed**—A wooden support for the quoin and breech of a gun, placed above the elevating screw.

**Stoppages of Pay** — The money deducted from a soldier's pay under the following circumstances:—

1. When at duty. This stoppage includes what he is liable for for his messing and his washing; it is not to exceed 5½d. a day.

2. Stoppages when in hospital:—

| | Men. | Boys. |
|---|---|---|
| If receiving hospital diet .. | 7d. | 6d. |
| If receiving medical comforts, but no diet .. .. .. | 6d. | 6d. |

In cases of illness brought on by the soldier's own misconduct, he is liable to a stoppage of the whole of his pay, with the exception of such residue as may be prescribed by the Articles of War for the time being in force.

There are also further stoppages as follows:—

Monthly, for hair-cutting, 1d.

To replace necessaries, &c., all his pay except 1d. a day.

When confined in military or provost prison, or in garrison cells, 1½d. a day for 28 or less number of days, if supplied with prison clothing.

Barrack damages, whole amount or share.

Marking clothing and necessaries (except first issue), ½d. per article.

Spirit ration, 1d. a ration.

Maintenance of wife and children—above rank of sergeant, 6d.; below, 3d. a day.

Fines for drunkenness.

On board ship, 1½d. for groceries, and 1d. for spirit rations or their equivalent.

**Stopper**—A plug placed in the muzzles of muzzle-loading small-arms, not in breech-loaders, to keep the bore free from rust, and to prevent dirt from entering into the barrel. It is made of cork or india-rubber, having a brass top. To make it thoroughly serviceable, the cork or india-rubber should be covered with serge or flannel.

A *stopper* is also a gasket or short piece of rope used to keep any weight suspended, or to take the strain off a rope, one end being always attached to some fixed object. It must be stronger than the rope it has to hold.

**Stopper-hitch**—A knot for stoppering the fall of a tackle, &c.

**Stoppering a Fall**—Making fast the fall of a tackle to some fixed object, at a point intermediate between the running and standing ends.

**Storekeeper**—A class of men found in certain government establishments where stores are kept. The receipt and issue of such stores are made by storekeepers under the supervision and orders of the head of the factory.

**Storm, To**—To make a vigorous assault on any position occupied by an enemy.

**Storming Party**—A select body of men, detailed to storm a position, fortress, &c. It is backed up by supports and reserves, and should be equal to about half the garrison of the work to be assaulted. (*Vide* Assault.)

**Strain on Guns**—The pressure exerted y the explosion of the charge, the abence or amount of windage influencing he pressure. There are two principal trains which the metal of a gun is ubjected to, a *transverse* or *tangential* nd a *longitudinal* strain. All guns are more or less subjected to these strains, nd the best test of a gun is that it bears he force of the gunpowder without being isrupted, or the parts of the gun being n any way affected. The friction of the rojectile in making its way up the bore s a great element of strain.

**Strake**, *vide* Streak.

**Stratagem**—Artifice in war. It is hus mentioned by Colonel Macdougall, n his 'Theory of War':—"The success f a stratagem depends mainly on he commander's knowledge of human ature in general, and of his opponent's haracter in particular. Its object is o deceive the enemy as to your signs. If you desire a general action, read reports of the weakness of your my and appear to avoid one. If the ntrary, put on a bold face, and pear desirous to engage. The emoyment of stratagem is particularly plicable to operations having for their ject the forcing of any long line hich it is impossible for an enemy to ard at all points, such as mountain ages, rivers, entrenched lines, &c." *Vide* Surprises.)

**Strategical Point**—Colonel Macdoull, in his 'Theory of War,' explains what ch a point is in warfare as follows:—Every point on the theatre of war, hatever be its *nature, which* conduces in any manner to strengthen your line of operation or of communication is a *strategical point.*"

He further explains that "*Decisive strategical points* are those only which are decisive in insuring the success of any operations of strategy either for offence or defence. . . . Thus, any point may, by the relative situations of the hostile armies, become a decisive strategical point; but the points most likely to do so are strong positions commanding the principal great roads, or a permanent bridge over a great river, or blocking up the approach to passes over a range of mountains."

**Strategy**—All movements which are not within the reach or view of the enemy belong to strategy. It embraces, as well, all arrangements of war prior to tactical operations; hence the organisation, administration, mobilisation, and all the complicated machinery of an army on a war footing come under this head. Strategical skill consists in unity of purpose and of action, in simplicity of design and vigour of execution, and in bringing large concentrated masses into action at the decisive point.

The following explanation of the object of strategy is given by Colonel Hamley, in his 'Operations of War':—"The object of strategy is so to direct the movements of an army that, when decisive collisions occur, it shall encounter the enemy with increased relative advantage. . . . The purely military advantages to be attained by strategical operations are of two kinds:—

"1. The probabilities of victory.

"2. The consequences of victory."

The particular objects of strategical movements are:—

"1. To menace or assail the enemy's communication with his base.

"2. To destroy the coherence and concerted action of his army, by breaking the communications which connect the parts.

"3. To effect superior concentrations on particular points."

**Straw**—The stalk of wheat, barley, &c. In the army, it forms the bedding of cavalry horses, and in the field, the bedding also of soldiers.

**Streak**—Iron plate fastened in pieces to form the tire round the circumference of gun-carriage or other wheels. This method is pursued in the home service in tiring large wheels. The artillery wheels of light or siege carriages at home and abroad have now one band of iron for the tire.

**Stream**—A small land current of water. (*Vide* River and Reconnaissance.)

**Strength**—Power of any kind. As understood in military matters, the term is variously applied, such as to a fortification, a fortress, or any other military position of magnitude. The word is also used in all returns of regiments giving the full number of men borne upon the establishment in contradistinction to the effective force, which means the number fit for duty.

**Strength, Tensile,** *vide* Tensile Strength.

**Stretcher**—A portable litter for carrying a sick or wounded man off the field of battle. It is so called from cross pieces or stretchers keeping the poles separate and the canvas stretched, thus producing a firm but soft surface for the disabled man to lie on. The weight of the English regulation stretcher is 15 lbs.

The requirements of a good field stretcher are: Firm, but not hard support for the patient, and one easily cleaned of blood and dirt; lightness, to facilitate carriage by bearers; strength, to resist shocks and rough usages of war; simplicity of construction, combined with capability of folding into a small compass for stowage. There must be no detached pieces, which are liable to be lost. Provision should be made for keeping the patient off the ground when the stretcher is laid down. The latest pattern consists of a tarred canvas bottom, attached to two ash poles, which are kept at the required distance apart by two jointed galvanised iron rods. It is fitted with four short iron legs, and has a pillow secured to the head.

**Stretcher Bearers**—Men of the army hospital corps whose special duty in time of war is to carry the wounded from the battle-field, to the ambulance, wagons, or field hospitals. The ambulance committee has recommended that 150 of these men should be attached to *each division*, and 36 to each brigade of *cavalry*. (*Vide* Krankenträger.)

**Strike, To**—There are several definitions of this word, but the most common is to touch or to hit.

*To strike a blow*, in warfare, is to make such an impression on the adversary as probably to insure victory.

*To strike a tent* means in castrametation to loosen the cords of a tent which has been regularly pitched.

The duty of *striking tents* is performed by the soldiers who inhabit them, and is carried out in accordance with rules bearing on that subject.

*To strike a gyn*, to dismount or take down a gyn.

*To strike a camp.*—The act of breaking up the camp. This is performed according to orders issued over night, which detail the hour for assembly, and the hour for reveille, as it is very desirable that the men should not be disturbed sooner than is requisite. Immediately after the reveille has sounded, the cooks should prepare coffee for the troops; whilst this is being got ready, the men pack up their blankets, and place them in the wagons. When they have finished their breakfast, fires should be extinguished, and tents struck and rolled up in their bags. All trenches and latrines should be filled up before the men leave the ground.

**Stripe,** *vide* Good-conduct Badges; also Badge.

**Stripping**—A term in gunnery given to the action of such projectiles as are coated with lead, and which, when fired from ordnance, throw off strips of lead, and thus prove sometimes very dangerous, particularly when firing over the heads of troops on active service.

**Strentia**—Is described as "an earth contained in a mineral, generally of a pale green tint and radiated crystalline texture, found at Strontian, in Argyleshire, which is a carbonate of strontium; strontia is the oxide of the metal strontium." The nitrate of strontium, which gives a red rose colour, is used in producing the red colour in fireworks and theatrical exhibitions.

**Stud**—A place where horses are bred or kept. In England, the government does not, under this name, possess any such establishment. Horses, when wanted, are purchased in the market, and distributed to the different regiments of the mounted branch of the service. In India, on the Bengal side, the government of that country possesses stud depots at Ghazeepore, Buxar, and Kurrentadhee, in the Central Provinces, and two in the North West Provinces, at Haupper and Saharunpore. They are under the control of officers of the army specially appointed, belonging to the *stud department*. When the studs do not produce a sufficient number of horses, they are purchased either in the country or in the colonies. (*Vide* Horse and Remounts.)

By a late order the name of *stud* has been changed to that of *remount*.

**Studs** — Projections or buttons on the surface of projectiles fired from rifled guns, for the purpose of making the shot take the grooving of the gun, and steadying the shot or shell in its passage out of the piece, also for preventing the body of the projectile resting on the bore.

The form of the studs on the upper surface of heavy muzzle-loading rifled guns is made to coincide with the grooves in the gun, instead of being concentric with the projectile.

The studs of all heavy projectiles of 7-inch M.L.R. guns and upwards are made of an alloy of copper and tin, and fastened on in the same way as those of the projectiles for the pieces rifled on the Woolwich system, viz. by being pressed into under-cut holes in the projectiles. All other projectiles have copper studs.

**Stuffing-box**—In Bourne's 'Catechism on the Steam-engine,' a stuffing-box is thus described:—"The hole on the cylinder lid, through which the piston-rod passes, is furnished with a recess called a 'stuffing-box,' into which a stuffing or packing of plaited hemp is forced, which, pressing on the one side against the interior of the stuffing-box, and on the other side against the piston-rod, which is smooth and polished, prevents any leakage in this situation. The packing of this stuffing-box is forced down by a ring of metal tightened by screws. This ring, which accurately fits the piston-rod, has a projecting flange, through which bolts pass for tightening the ring down upon the packing; and a similar expedient is employed in nearly every case in which packing is employed."

**Sub** (Latin = under)—A familiar abbreviation used in the British army to signify a subaltern.

**Subahdar**—A native officer of the Indian army whose position corresponds with that of a captain in a European company of infantry. It is also the Hindu name for the governor of a *subah* or province.

**Subahdar - Major** — The native commandant of an Indian regiment of infantry.

**Subaltern** (Latin, *sub*, under; *alternus*, another)—Literally means below another. The term is applied to a commissioned officer in the army under the rank of captain.

**Subdistrict of the Army,** *vide* Brigade Depot.

**Subdivision**—In artillery, a gun with its wagon. In the infantry, before the change in drill took place, half a company was called a subdivision.

**Sub-lieutenant** — The rank which has been introduced into the service in lieu of that of ensign. It is given to all cadets (cavalry and infantry) after passing the prescribed examination before the Civil Service Commissioners, if the vacancies in the army permit of the number who have passed being gazetted.

The regulations on the subject require that all who have passed the examination (except those posted to regiments in India) shall proceed to Sandhurst, and there complete a professional examination in military drill and all other military subjects, after which they will be posted to regiments. The sub-lieutenants sent to regiments in India will pursue similar studies, and undergo similar examinations in that country, before the garrison instructor of the district, to those they would have followed at Sandhurst.

The above rules are to be altered from January 1, 1877.

**Sublimate, Corrosive,** *vide* Corrosive Sublimate.

**Sublimation** (Latin, *sublimis*, on high) —Is explained as "a process by which solids are, by the aid of heat, converted into vapour which is again condensed, and often in crystalline form. This operation is frequently resorted to for the purpose of purifying various chemical products, and separating them from substances which are less volatile." The process is observed in the distillation of sulphur, the result being "flowers of sulphur."

**Submarine Mine,** *vide* Torpedo.

**Subordination**—Subjection to the will of another; under command; readiness to submit one's self to the orders of superiors. In the army, this feeling cannot be too deeply instilled into all ranks. Without it, no body of men could work together; like discipline, it is the mainspring of order; and unless it reigns supreme in every regiment, confusion and every imaginable evil must ensue. In effect, as James, in his 'Military Dictionary,' states, it is *subordination* that gives soul and harmony to the service; it adds strength to authority and merit to obedience, and, while it secures the efficacy of command, reflects honour upon its execution. It is *subordination* which prevents every disorder, and procures every advantage to an army.

**Subsidiary**—As applied to war-time, means the help or assistance given by the troops of one nation to those of another upon the payment of a certain sum of money.

**Subsidy**—A sum of money given to a foreign power to enable it to carry on a war by procuring unlimited succour of auxiliary troops, ships of war, provisions, &c.

**Subsist, To**—To maintain with food and clothing. In a military sense, to give pay, allowance, &c. to soldiers.

**Subsistence Money**—An allowance granted for the subsistence of soldiers who, whilst in imprisonment in cells, or confinement in the guard-room, forfeit their daily pay. The regulated rate is 6d. a day. (*Vide* Queen's Regulations.)

**Substitute, Military**—One who takes the place of another in the conscription for a certain remuneration; at least, this is the case in continental countries where conscription is the mode of raising troops for the army. Substitutes are readily found among military men who have already served their prescribed period.

**Succour**—Assistance in men, stores, or *ammunition*. *To throw succour* or help *into a place* means to introduce armed men, ammunition, provisions, &c. into a besieged place.

**Succour, To**—To come to the rescue; to help when in difficulty; to relieve a force requiring assistance.

**Sulphur**—A yellow brittle mineral, found in different parts of the world. England receives its supply from Italy and Sicily. In India it is obtained from the Persian Gulf, Sinde, Sumatra, and Burmah, and for the gunpowder factories is often exported from England; most volcanic regions yield it. Before it can be used for gunpowder purposes, it has to be distilled to free it from all impurities, and especially from all acids. The following is taken from the late Major Baddeley's pamphlet:—"A large iron pot or retort is set about 3 feet off the ground, or about the height that an ordinary boiling copper is placed, having a furnace underneath. This pot has a movable lid, which is fixed into the top of the pot with clay, and in which lid is an iron conical plug removable at pleasure. From the pot lead two pipes, one to a large circular dome, and another to an iron retort rather below its level. The latter pipe has an iron casting or jacket round it, which can be filled with cold water. When desired, the communication of these pipes with the melting-pot can, by a mechanical arrangement, be shut off or opened as occasion requires. About 5½ to 6 cwt. of grough sulphur is broken into small pieces placed in the iron melting-pot, and subjected to the action of the furnace. The plug-hole in the lid and the pipe leading to the dome are now left open, but the pipe leading to the receiving-pot is closed. After about two hours, a pale yellow vapour arises, when the plug is put in, and the vapour is conducted into the dome, where it condenses on the sides and floor in the form of an impalpable powder, commonly called 'flowers of sulphur.' A small pipe leads from the bottom of the dome on the opposite side into a tub filled with water to allow the escape of the air, and sulphuric acid is taken up by this water. In about 1½ to 2 hours after, the vapour becomes a deep iodine colour, when the communication with the dome is shut and that with the receiving-pot is opened; at the same time, cold water from a tank above is allowed to pass into the jacket covering the latter; the vapour then distils over, is condensed into the pipe, and runs into the retort below in the form of a thick, yellow fluid; when nearly all has distilled, which can be known by the jacket getting cold, the communication is again closed with the retort, and the fluid sulphur left an hour to get sufficiently cool to ladle out into moulds; the furnace door and the communication with the dome, at the same time, are again thrown open, that the rest of the vapour may pass into the latter. The flowers of sulphur thus obtained are used for laboratory purposes, being unfit for the manufacture of gunpowder from the acid they contain; and the crystalline sulphur, after being allowed to cool in the moulds, is barrelled up, and used as the third ingredient in gunpowder. To ascertain the purity of sulphur, if a small portion is burned on a piece of porcelain, no residue should be left; also, if it is treated with distilled water, litmus paper should not be discoloured."

A description of the refining apparatus, with plans, is given in the 'Handbook of the Manufacture and Proof of Gunpowder,' by the late Captain F. Smith, R.A., assistant superintendent of gunpowder at the Royal Gunpowder Factory, Waltham Abbey.

**Sulphide of Lead,** *vide* Galena.

**Sulphuric Acid,** *vide* Acid, Sulphuric.

**Sumpter Mules**—The baggage mules of early English armies were called *sumpter mules*. The term is obsolete now in the British, but is still retained in the American army.

**Sun Telegraphy,** *vide* Telegraphy.

**Sunken Battery,** *vide* Battery.

**Superficial Measure**—The measure of surfaces or area; also called *square measure*.

**Superheated Steam** — Steam heated above the temperature due to its pressure. It is used as a means of economising fuel.

**Superior Slope**—In fortification, the slope of the parapet towards the country.

**Supernumerary** — A term signifying above the number, and, when applied to an officer in the army, means that, on being detached from his regiment *on staff* or other employment, he becomes supernumerary, and has his place and duties in the regiment taken by another officer, promoted from the next lower rank. Under these circumstances, the officer in staff employment is in excess of the regulated number of officers of that grade, and is shown in italics in his regiment as such. After serving five years away from his regiment, he returns to it, and remains a supernumerary, until absorbed; or should his regiment be in India, or ordered home, he must then rejoin his regiment.

**Superseded, To Be**—To have another put in one's stead.

**Supplies**—Necessary stores and provisions furnished to troops. Under the latter head are rations (*q. v.*) which are supplied by the commissariat.

On an army taking the field, food of various descriptions is dealt out to it from day to day, arrangements being made by means of supply carts to carry the food from the nearest magazines. If fresh meat can be supplied in the country, well and good; if not, salt meat will form one portion of the ration. Bread is provided by travelling bakery wagons.

In time of peace the method of supply is by contract for the principal articles of sustenance, such as bread, meat, corn, hay, straw, &c., which the commissariat inspects and issues. Smaller articles, such as groceries, &c., are purchased by the soldier. In large standing or permanent camps in the country, butcheries and bakeries have been introduced, and with advantage to the efficiency of the commissariat.

In war-time, there are four sources from which an army can be supplied:—

1. Supply from home;
2. By contract, delivery to be made at base of operations;
3. By purchase in the country occupied;
4. By requisition or seizure; or by a combination of all the four above mentioned methods.

The fourth mode, viz. by seizure, would be exceptional, and even then everything would have to be paid for. Nowadays, an army for the most part is dependent for its supplies on the different magazines (q. v.) established in its rear.

The English method of payment for all supplies in an enemy's country is the more certain and satisfactory mode of obtaining what is required, especially in a poor country and over a restricted area. For though the system pursued by the French during the Peninsular War, of forced requisitions, enabled them to support their troops when the English could not, experience has shown that the principle we have adopted is the most sure in the end, the most just, and establishes a good feeling between the army and the inhabitants. In 1814, in the south of France, Wellington was able to maintain his army in abundance from carrying out this system, whereas the French army was almost starving in its own country, the population preferring ready money to *bons*. The Prussians, in Bohemia, in 1866, suffered great want, though the country abounded in cattle, from the inhabitants driving their cattle away into the mountains, to escape requisitions. In the Franco-German war, the Germans, it is said, gave up this system, and purchased all articles of food.

In the defence of a place such as a large fortress, every endeavour must be made to husband the resources within it. The food which will keep longest, such as biscuits, must be kept to the last. The surrounding country, as far as is possible, should be made to yield all it can up to the last moment, and all food in the hands of the inhabitants should be seized; and when once shut up, everyone within the fortress who is able should contribute to the common store such supplies as each possesses.

Each German army corps on war footing carries in provision wagons four days' rations for men, and a further number of wagons carrying six days' rations for men and horses. The latter wagons maintain connection with the magazines. The soldier himself carries three days' ordinary and three days' reserve rations.

**Supplies, Director of,** *vide* Director of Supplies and Transport.

**Supply Department** — A branch of the control department (*q. v.*), now abolished, and replaced by the commissariat department. (*Vide* Addenda, Commissariat Department.)

This department has for its object, as its name implies, the providing of an army with food, whether in time of peace or war.

**Support**—An aid; a sustaining power. In military manœuvres, the term *supports* is given to a technical formation, being the second line in a battle, either in the attack or the defence. (*Vide* Skirmishers.)

**Surcharged Mine,** *vide* Compression, Globe of.

**Surcingle** — A girth made of strap leather and attached to the saddle. It consists of a long body and short strap, and is buckled with exactly the same degree of tightness as the girth, the buckle being placed so as just to touch the lower edge of the near flap of the saddle.

**Surcoat**—A tunic worn by knights of the middle ages over the coat of mail; it was usually made of silk of one uniform colour, but sometimes variegated, sometimes richly embroidered.

**Surgeon**—A medical officer attached to regiments to assist the surgeon-major in his duties. (*Vide* Addenda, Medical Department.)

**Surgeon-Major**—A medical officer who is attached to and in medical charge of a regiment. He is assisted by one or more medical officers subordinate to himself. As senior medical officer, he remains always with the head-quarters of the regiment when any portion of it is detached.

**Surprise, To**—Suddenly to come upon the enemy.

**Surprises**—Certain stratagems of war made use of by an army wishing to take an enemy unawares. The object of such an attack is with the view of surprising and capturing some important post, stronghold, &c., or to disconcert the enemy in some unexpected way. To carry out such a movement necessitates great secrecy being observed, in order that the enemy may have no suspicion of what is intended; and with this view great precautions must be taken to prevent information being carried to the enemy by spies, villagers, or any other party likely to be favourable to the opposing force.

The troops detailed to carry out the surprise must be composed of men of strength and vigour, whose *physique* is equal to any fatigue, and who are confident in themselves as to their power of executing the duty imposed upon them. Guides should accompany the force, and be distributed among the troops in such a manner as to prevent wandering from the right path. Before and after the departure of the surprising party, no one should be allowed to leave the camp or fortress for a considerable time, so as to prevent any information being taken to the enemy of what is going on. Patrols of cavalry should be sent out around and about the camp at some distance to pick up stragglers, who may be likely to carry intelligence to the enemy.

There are no laid-down rules for carrying out a surprise. The instructions given to the party must depend on circumstances, which the general in command of the army will be best able to explain. Much must be left to the intelligence and ingenuity of the officer commanding the party to bring the attack to a satisfactory conclusion. Secrecy, however, is the chief point to be observed.

"History," as James, in his 'Military Dictionary,' states, "furnishes us with various instances in which fortified places, strongholds, and gates, have been surprised. There are others again in which surprises have been practised with success by means of spies and of secret intercourse with one or more of the party against whom you are engaged."

**Surrender, To**—To give up possession of anything. In battle, when unable to make good one's retreat, or in the case of a fortress being unable to stand out against the attack of the besiegers, to surrender is then to lay down arms and to give up the garrison as prisoners of war.

Not by force of arms alone has a fortress to surrender; it may have to do so from being starved out by the besiegers.

The greatest surrender of troops in the field that we are acquainted with in late years is that of the French army at Sedan; of fortresses, that of Strassburg, of Metz, and others in France during the Franco-German war of 1870–71.

*To surrender at discretion* means to give oneself up, or to deliver up an army or a fortress, into the hands of the victorious general without stipulating any terms.

**Survey, To** (French, *survoir*, to overlook)—The art of measuring and determining the boundaries and superficial extent of any portion of the earth's surface. Surveying is carried out either by means of a chain or with the aid of angular instruments.

*Trigonometrical survey* is the highest branch of measurement of the earth's surface, in which the use of instruments, such as the theodolite, the sextant, &c., is indispensable in forming the network of triangles upon which the accuracy of the survey depends. This nature of survey is used for making geographical maps, or for measuring an arc of the terrestrial meridian.

In India the trigonometrical survey has been carried on for many years past under the supervision of the Indian, now royal, engineers.

*Topographical survey* is a minute and particular description of places, as rivers, hills, woods, villages, roads, bridges, and other buildings. This nature of survey is generally applied to military purposes, in the formation of maps for the guidance and information of the general in command, who should possess a thorough knowledge of the physical conformation of the country, its obstacles and resources, in which he has to operate.

Frederick the Great was one of the first to recognise the value and necessity of such information, as it enabled the commander of a force, technically, "to see before him." Good military maps of a country are most useful either to the invaders or invaded; but it frequently happens that the field of warfare is one of which no careful survey has been made or is procurable. Officers of the staff are therefore required to make good this deficiency, by traversing with rapidity the country to be surveyed, measuring the distances by their own pace or that of their horse, and obtaining a rough knowledge of the hills, rivers, valleys, &c. by a rapid glance or by means of angular instruments, such as the pocket sextant or the prismatic compass; and, having obtained all the necessary information, submitting a topographical survey of the whole country reconnoitred.

Such surveys or military sketches are furnished by the topographical branch of the intelligence department (*q. v.*), but the execution of them devolves, in the field, on the quartermaster-general's department.

In peace-time advantage is taken by

the intelligence department to secure maps and all information of countries which may become theatres of war. In these maps every detail likely to assist the commander should be delineated. A careful reconnaissance of the country would also give the necessary information.

In most countries the topographical surveys are either completed or in progress. In England all operations connected with such surveys are, with the cadastral survey, concentrated in one department, the *ordnance survey*, which since 1870 has formed part of a purely civil department of the state, the Office of Works. Originally the topographical survey was purely a military survey, but for many years past the ordnance survey maps have been constructed with the paramount view of general utility to all classes in the kingdom, and the military character of the topographical map on the 1-inch scale has given way to the civil requirements of the state. On the continent the topographical survey is conducted by the war department of the country.

Abroad, as well as in England, large establishments are kept up for the reproduction of topographical maps, whereby an infinity of copies can be struck off by the process of photography, photozincography, photolithography, heliogravure, and papyrotype.

Surveys are drawn on different scales (*q. v.*), and those surveyed upon a 25-inch scale take the name of *cadastral surveys*. (*Vide* Cadastral, and Map.)

**Surveyor-General of Ordnance**—One of the three great officers of state, whose department has the supply of all kinds of stores, transport, and quarters.

**Suspension Bridge**—A bridge made of rope or chain, and employed in military operations to effect a passage across an opening where no intermediate points of support are obtainable. Suspension bridges can be made also, in case of emergency, of Jones' iron gabion bands, joined together by bolts and nuts, and used from one to four thicknesses according to the strength required.

**Suspension of Arms**—A short truce (*q. v.*) between hostile armies to enable them either to bury their dead or to treat with the view of making proposals for surrender, &c.

**Suttlers**—Camp followers (*q. v.*).

**Swage Tools**—Rounding tools for the heads of screws, collars, flanges, &c.

**Sweep Bar**—The rear bar of a siege howitzer limber (O.P.), which connects the futchels.

**Swingle-tree**—Used for draught purposes and fastened to the splinter bar on the near side of the shaft.

**Switches**—As explained in Brande and Cox's 'Dictionary,' are "movable rails, which are used to deflect a train from one line of rails on to another. At one end they are fixed to a centre, while the other end, which is tapered to a point, is moved against the side of the rail by a horizontal rod and handle, to which a heavy weight is attached to bring back the switch to its normal position as soon as the handle is released. Switches are either single or double, the first being made with one movable rail, and the second with two. Double switches are usually employed for sidings, as they throw the rails less out of gauge, and less disturb the continuity of the line."

**Swivel-gun**—In artillery, a gun fixed on a swivel either on the back of an animal, such as a camel, or on a wall, or any commanding position.

**Sword**—An offensive weapon, consisting of a steel blade, long and pointed, flat or triangular, and slightly curved, encased in a sheath of steel, brass, or leather. The handle has a guard and pommel, in which the tongue of the sword is rivetted. The sword is a weapon in general use throughout the world, and is the arm of the British cavalry, except in the Lancer regiments. The mounted artilleryman's sword is a cavalry sword; that of the dismounted branch, a short sword. The swords used in the British service are made at Sheffield. (*Vide* Appendix F.)

During the Anglo-Saxon period, A.D. 450–1016, as stated by Lieutenant-Colonel Luard, in his work on the early history of 'The Dress of the British Soldier,' the sword, like all the other weapons of that period, was made, very wisely, of iron, two-edged, long, and straight —"long broadswords double-edged."

During the reign of Edward IV. the following swords were in use in Europe:—The bragemort or short sword, the French *rencontre* sword, the *saccado* or long sword, the *espadan* or two-handed sword, the Swiss or *basket-hilted* sword, a Spanish sword called the *toledo*, or more properly *rapier*, a tuck inclosed in a walking-stick, a poniard, a dagger, sabre, and scimitar.

**Sword Exercise**—The method of teaching the use and practice of the sword. As stated in the revised 'Infantry Sword Exercise,' "the object of the sword exercise is to give quickness and dexterity in the use of that weapon, and this can easily be acquired by practising the movements laid down in the drill-book."

**Sword-bayonet**—A weapon which can be used either as a sword or a bayonet. It has been issued to the engineers, to rifle regiments, and to sergeants of the line, and it is contemplated to issue it to the foot artillery. The weight of the sword-bayonet is 1 lb. 15 oz.; that of the scabbard (leather), 9½ oz.; the length of the blade is 25⅜ inches.

## T.

**Tabard**—An upper military garment which was generally worn in the reign of Richard II., and continued in use till the time of Henry VIII. It was a species of tunic, which covered the front and back of the body, but was generally open at the sides from the shoulders downwards. From the time of its first introduction it was used by the military; afterwards it was emblazoned like the surcoat with armorial bearings.

**Table, Round**—A knightly but somewhat mythical brotherhood, instituted as a distinction for military merit, by King Arthur, son of Uther Pendragon, third son of Constantine. It consisted of twenty-four knights, of whom the king himself was chief, who came from all parts to the court at Camelot, to give proof of their prowess in arms. To avoid jealousies and questions of precedence, King Arthur *caused a round table* to be made for these festive gatherings, whence the knights were called Knights of the Round Table. At Whitsuntide in each year, they used to meet in full conclave at Winchester, where may now be seen what tradition asserts to be the famous Round Table itself; though the learned in such subjects say that its date is of no greater antiquity than the reign of Henry VIII.

**Tabling**—In carpentry, the process of letting one piece of timber into another so as to form one solid piece. This method is very often resorted to when wood of sufficient scantling is not to be obtained for any particular work, such as the beam of a gun-carriage.

**Tackle**—A machine for raising and lowering heavy weights. Tackles are thus described:—"A *simple tackle* consists of one or more pulleys rove with a single rope. The rope is termed a *fall*, and the pulleys are called *blocks*. When a tackle is in use, one end of the fall is made fast, the other is hauled upon. The fixed end is called the *standing end of the fall;* the other, the *running end*. Each separate part of the fall contained between two blocks, or between either extremity and a block, is called a *return of the fall.*

"*To overhaul* a tackle is to separate the blocks.

"*To fleet* blocks is to bring them as close together as possible by hauling on the fall. Wooden blocks are generally bound on the outside, in the direction of their length, with a grummet, which is called the *strap* of the block.

"If the strap be continued, so as to form a *tail*, at the end of the block which has no hook, the block is called a *tail* or *jigger block*, and if a tackle has its movable block so furnished, it is called a *jigger tackle*. A single movable block is called a *whip*; another single block applied to the fall converts it into a *whip upon whip*. Two double blocks, one fixed and the other movable, make a *gun tackle*. A single and a double block, the former fixed and the latter movable, make a *luff tackle*.

"A treble and a double block, the former fixed, the latter movable, are called a *gyn tackle*.

"A *runner* tackle is merely a luff

tackle applied to the end of a large rope rove through a single block."

**Tactical Points**—Are thus defined by Colonel Macdougall:—"All points on a field of battle which may impede the advance of an enemy to attack your position, or which may facilitate the advance of your army to attack the enemy's position, are *tactical points*, and should be occupied."

"*Tactical decisive points*," he further explains, "are points on a field of battle which, when occupied by your army, will enable it to make an attack on the enemy, whose success would be decisive on the issue of the engagement; and all points on a field of battle in possession of the enemy which will enable him to frustrate your attack on any other part of his position, or which will enable him to impede or intercept your line of retreat, if repulsed, are *tactical decisive points for offence.* Reverse the conditions, and you will obtain the tactical decisive points *for defence.*

"The flanks and most advanced salients of the position are, in general, the most decisive points."

**Tactics**—All movements of an army executed in presence of or near an enemy; the manœuvres carried out on the battle-field.

"The tactics of a soldier," writes Colonel Burne, in his 'Military Dictionary,' "are the correct performance of military movements; those of an officer, to know how to direct their execution, and those of a general, to combine them in such a manner as to ensure success." Under tactics are included the different orders of battle, positions, attacks, pursuit, retreat, all of which subjects will be found separately treated each under its own head.

From feudal times, when soldiers were armed with axes and shields, to our days of rifled guns and breech-loading rifles, tactics have undergone great and remarkable changes, the formation of lines of battle getting thinner and thinner as weapons became improved. The Greeks fought in a depth of sixteen and even eighteen ranks; the Roman legions in ten, and towards the end of the empire in eight and subsequently six ranks deep. These formations gradually decreased on the continent to three ranks until 1713, and that formation remained so until two ranks were adopted. This again was modified to meet the requirements necessitated by the introduction of arms of precision; and loose formation and skirmishers are now required where, under previous conditions, solid and compact bodies were maintained. Extended movements necessitate that, for the infantry, troops should be divided into a first line composed of skirmishers (*q. v.*), a second line (first and second supports), and a reserve; and thus the component parts of a tactical formation are threefold instead of twofold as before. This formation gives a greater facility of deployment, adding at the same time greater power to troops of taking advantage of the shelter offered to them during the advance, and thus lessening the number of casualties.

The tactics of the mounted branches of the army have also been considerably changed of late. The cavalry (*q. v.*), to which ancient and modern leaders owe most of their victories, will not, probably, take in the future the prominent part it has played in the past. Its duties during a campaign belong more to strategy than to tactics, and, therefore, every cavalry reform has tended of late towards giving a more complete independence to that branch of the service. Notwithstanding, as exemplified by late wars, cavalry can still be called upon to render great service in certain cases of emergency, such as keeping in check an advancing foe, silencing guns, and in pursuit. In attacks of cavalry against cavalry, long lines very rarely occur; during the late wars, cavalry was never or seldom used with a very large front, that of a regiment being usually about the extreme. Attacks in open column, that is, with a body immediately in support, and another in rear as reserve, have been generally made; attacks in échelon, either in échelon from the right or left or échelon from the centre, being generally useful, as well as those of oblique formations on either flank.

With the great power of rifled guns and the destructive effect of Shrapnel, cavalry is taught to show itself in bodies as little as possible within range of the enemy's artillery. In attacks on batteries, either to silence the guns or to force them to limber-up for a time, a formation in skirmishing order has been advocated, that is, one troop extended, supported by a squadron with open files to advance rapidly upon the guns.

Cavalry, in future, may not be able to act successfully against steady infantry in thorough formation. During the war of 1870–71, the German infantry received the charges of the French cavalry in open order, the men firing from behind cover, the old square formation being thus abandoned. Cavalry movements, in the future, will be, probably, directed towards turning a flank or piercing a centre.

The adoption of rifled guns has not been without its influence on the tactics of field artillery, but the general principles on which the tactics of that arm are based have not undergone notable changes, and its main *rôle* has remained what it used to be—to prepare the path for cavalry and infantry. Artillery opens fire only when within a good range of the enemy; in favourable circumstances of weather and of open ground, it is now impossible to maintain column formation under the fire of rifled artillery at any distance under 4000 yards. Shrapnel shell can be used with considerable effect, even against skirmishers, at ranges under 2000 yards. Important results can be obtained by concentrating the fire of artillery on one point if possible; this is effectually gained by massing guns (*q. v.*). The use of field batteries greatly depends on their mobility. The Germans, during the war of 1870–71, pushed their artillery to the front, in advance of the skirmishers, with the object of gaining time and establishing a superiority of fire early in the battle.

The following principles on the subject of artillery tactics are taken from Lieutenant-Colonel Brackenbury's lecture at the United Service Institution on April 28, 1876:—

"1*st principle.*—Since field artillery can move at a trot, and its fire is of great value at all stages of a battle, and at all ranges, a general should endeavour to obtain a superiority of artillery as early as possible. To gain this, his whole, or nearly his whole, *force of guns* should be pushed well forward and massed at the beginning of a combat, so that it may crush the enemy's artillery in detail as the latter comes into position. 2*nd principle.*—Whether acting offensively or defensively, artillery can protect its own front in ordinary open country, and should not retire before infantry unless the whole force is retreating. 3*rd principle.*—But artillery can be sorely annoyed, or even caused to retire, by the fire of infantry skirmishers, well concealed in folds of ground or behind walls and trees. Therefore infantry should not attack in any formation, but, so to say, stalk the guns, and this being granted, infantry always attack guns; who knows but that they may be unsupported? 4*th principle.*—The only reply to such hidden attacks, early in the battle before the friendly infantry has come up, is by the use of dismounted cavalry; or, better still, by mounted men trained to work on foot either as riflemen or gunners, and permanently attached to the batteries. 5*th principle.*—Since artillery can take care of itself, provided its flanks are protected, a line of guns may be deployed, and behind it the infantry may effect turning movements to act on the enemy's flank. When such a flank attack is ready to be delivered, the mass of guns should concentrate their fire on that part of the enemy's line about to be assailed till it is shaken. 6*th principle.* — A system of signals should be devised and used so as to enable a large number of guns to act simultaneously against the same point. 7*th principle.*—When the infantry combat has commenced, as many guns as possible should be pushed close up to the enemy—say, within 1000 yards—or to that distance where they will find the best and nearest positions to the enemy. 8*th principle.*—When artillery advances to close combat, a considerable number of men and horses should follow the batteries as near as they can consistently with keeping under cover. If this be done, there is no fear of leaving the guns in the hands of the enemy. At such moments cover becomes a secondary consideration. Artillery, like infantry or cavalry, in close combat must count on heavy losses in men and horses, but they must determine to crush the enemy in that part of the field, remembering that 'omelettes are not made without breaking of eggs.' 9*th principle.*—Since a frontal attack can be beaten off at any range, artillery, if it has a clear space of 1000 yards in front of it, and scouts on flanks, should not allow itself to be turned from its immediate purpose by the reported approach of large bodies of infantry. Such attacks may be neglected till the enemy comes within 1000 yards. 10*th principle.*—Range-finders, telescopes, and scouts are indispensable to the development of the full power of artillery; the same may be said of spare men, horses, and ammunition. The front line of the battery should have as few men and horses as possible, and should be fed from the rear, two or three times over if necessary. But the great principle of all, and that which must underlie all minor ones, is that artillery has issued from its childhood, and is as well able to shift for itself as any other arm. This does not mean that it is independent of the others, but that it is only dependent on them in the same sense that they are dependent on it. Cavalry should feel the way, and be ready afterwards to support the guns with the dashing self-devotion characteristic of its nature and history. The infantry should never forget that the guns in front may be sorely in need of the arm which can do everything but move quickly. Artillery is, after all, only preparing the way for the glorious strife of the foot-soldiers. The gunners are dying that the infantry may live and win the day. On the field of battle we are all brothers, and our only rivalry should be to try which can, at any sacrifice, do most for the common good."

In general tactics, the erroneous principle of remaining on the defensive has been abandoned, notwithstanding the great advantage given to that system by modern arms; the danger in assuming the offensive from such a position is avoided by a vigorous and rapid attack, by a well-directed fire, by making use during the advance of all accidents of ground, and lastly by combining an advance on either or both flanks of the enemy with a front attack, in order to harass and perplex him.

***Tambour*** — In fieldworks, a small *stockade*, made in the shape of a redan or lunette, and placed in front of a long loop-holed wall, by which means a flanking defence is given to the wall. An opening is made through the centre of the wall to give admittance into the *tambour*, to the entrance of which a stout door or barrier should be provided, and loop-holed to fire through, if forced.

**Tampeon,** or **Tompion**—A wooden plug of the diameter of the bore of the ordnance it is intended to fit. Tampeons are placed in the muzzles of ordnance to exclude dirt and wet from the bore, but they are no preventive against moisture, unless they are covered with serge. It is much better, therefore, if the precaution of binding them with serge is not taken, to leave the bores exposed to the circulation of the atmosphere. The cylindrical portion of the tampeons, which is made partially hollow for lightness' sake for heavy M.L.R. guns, is covered with woollen serge and strips of leather sewn upon it to fill the grooves in the gun. The tampeons of B.L.R. guns are somewhat different, the cylinders being solid, and having no leather strips. Tampeons for field guns have two or three thicknesses of cotton cloth glued on the portions which enter the bore.

**Tamping of Mines**—As described in the 'Instruction in Military Engineering,' 1870, "consists of filling up the gallery with solid material, for a certain distance from the chamber, with the view of preventing the force of the explosion expending itself in the gallery, rather than in the direction in which the mine is required to act. The tamping should extend from the charge for a distance equal to at least one and a half time the line of least resistance (or twice for a three-lined crater); and if the material used for forming the tamping be not or but loosely packed, this distance should be twice that line."

**Tangent**—In geometry, a straight line is said to be a tangent to a circle when it meets the circumference in one point only.

**Tangent Block,** *vide* Block, Tangent.

**Tangent Scale,** *vide* Scale.

**Tangye Hydraulic Jack,** *vide* Jack, Lifting.

**Tanned Hides,** *vide* Hides, Tanned.

**Tap**—A hardened steel screw with a square head, which can be turned by a wrench. It is grooved from end to end, and is slightered tapered. It is used for cutting an internal screw, as that of a nut, &c.

**Tapets**, or **Laces**—In ancient armour, flexible plates, which were hooked on to the skirts of the cuirass.

**Tappet Ring**—The ring which is fitted on the octagonal part of the breech screw of an Armstrong gun, and is what the lever acts upon for working the breech screw. Should it be removed for any purpose, care must be taken that it is returned to its seat in the same position it occupied at first, for if fixed in any other way, the lever will not act on it in a proper manner. A separate ring called the *indicator* is placed in front of the tappet ring in the N.P. 40-pr. guns, and has an arrow cut upon it, which must correspond with a similar arrow cut on the gun to show that the vent piece is "home."

**Taptoo**, or **Tattoo**—The beat of drum announcing the hour at which the day closes in, when all day duties cease, and night duties commence, and when soldiers must be in quarters, The hour varied, until very late, according to the season of the year. But it is changed now to 10 P.M. throughout the year. At foreign stations this hour is to be adhered to as far as is practicable, but it may be changed at the discretion of general officers commanding, to suit the degree of latitude in which their respective commands are situated.

This rule does not apply to troops on active service in the field, and the tattoo is to be sounded at such an hour as may be ordered by the commander of the forces.

**Tar**—A dark brown viscid liquid, chiefly extracted from the roots of the fir, by a kind of distillation, a slow combustion of the tree taking place by certain means, as in making charcoal.

**Tare**—In commerce, the weight or allowance made to the purchaser for the weight of the case, cask, or package containing the goods or articles purchased.

**Target**—A mark to be fired at. For light gun practice, targets are made of wood, 6 feet by 6 feet, and ½ inch thick; targets for heavy guns firing seawards are floating targets (*q. v.*). Targets for small-arm practice are made of cast iron, 6 feet by 2 feet, with circular bull's-eyes and centres, according to the latest pattern. The thickness of the plate is ⅜ inch, bulked up to 1 inch in the centre. (*Vide* Addenda, Musketry Drill.)

**Tarpaulin**—Canvas covered with tar for the protection of stores against wet and damp. This nature of paulin is not generally used on the Bengal side of India, a waxed paulin having been substituted for it.

**Tartan**—A pattern cloth of different colours, printed side by side and crossways, forming the well known checkered pattern. The tartan pattern admits of great variety of modifications, each clan in Scotland having its own pattern. The Highland regiments have each distinctive tartans.

**Teak** (*Tectona grandis*)—This is the staple timber of India and Burmah, and the most useful and durable timber known, soon seasoning and easily worked. The Malabar teak is superior to that of Burmah in strength and durability. Good teak resembles coarse mahogany, with reddish-brown streaks, having close and straight grains. A cubit foot of unseasoned wood weighs 55 to 60 lbs. It is extensively used in the Bombay Gun Carriage Agency.

**Team**—Two or more horses or animals of any description harnessed together. Thus, in applying the term in artillery draught, it means the horses attached in double draught to batteries, according to the custom of the service. (*Vide* Harness.)

**Technical Troops**—A name given to a body of troops peculiar to Germany and Austria, consisting of men trained in technical engineer duties, but incorporated with the different battalions of the guards, line, and *Landwehr*. They do not seem, during the campaign of 1870–71, to have been of much use, for, brought under fire in conjunction with their comrades, they suffered severely during the earlier actions, and afterwards the battalions to which they belonged were so weak that the technical troops were retained for the ordinary duties of infantry soldiers. Our pioneers could easily be converted into an equivalent force.

**Teeth of Wheels**—In machinery, those prominent portions in the peripheries of wheels which, locking in each other, convey the power of a prime mover to the working parts of the machinery.

**Tegulated Armour**—Ancient armour,

worn in the time of Stephen. It was composed of small square plates of steel, lapping over each other like tiles.

**Telegraph** (Greek, *tele*, far off; *grapho*, I write) — A means of communicating intelligence to a great distance by various signals or movements previously arranged. The conveyance of information by signals was practised from the earliest ages; but a telegraph universally applicable was first described by Hooke in 1684. It was not, however, put in practice, nor was telegraphic communication applied to any useful purpose until 1794, when it was used to convey intelligence to the French armies.

**Telegraphy**—The art of conveying intelligence by means of the telegraph. In the army, telegraphic communication is carried on by two methods, visual signalling and the electric telegraph.

*Visual signalling* was formerly carried on by *semaphores* (*q. v.*), but it has been superseded by army signalling and sun telegraphy.

*Army signalling* (*q. v.*) is carried on by means of flags during the day, and by coloured lamps, or by a system of long and short flashes, during the night.

These modes of corresponding are useful at distances over half a mile and not exceeding 8 miles.

*Sun telegraphy* is a system of correspondence by means of the sun's rays.

Making use of the sun as an agent to convey intelligence is of a very ancient date. It is stated that Alexander the Great caused his fleet to be guided along the Persian Gulf by means of mirrors. The Russians had recourse to this mode of telegraphy during the siege of Sebastopol, and it is practised to this day by the Indians in the North American prairies. During the last century it was employed to connect the meridians of Paris and Greenwich, and out of this measurement sprang the trigonometrical survey of the United Kingdom. The system, as at first carried on, was by means of Argand lamps, substituted later on by lime-lights; and in 1822–23, Colonel Colby, R.E., who conducted the survey, devised a sun-flashing instrument, which was attended with much success. Captain Drummond subsequently produced an instrument far more effective, but more delicate and complex, known as the heliostat (*q. v.*), by the means of which the surveying officers were enabled to make their observations at three times the distance they could previously, with much greater ease, and with far less liability to error. At the same time, Professor Gauss invented a similar instrument, which was used by him in the survey of Hanover; and with subsequent modifications, such as reducing the complexity of the instrument, dispensing with the telescope, &c., the heliostat then became what it has ever since remained. The heliostat, which is in no sense a talking instrument, although used at times by surveyors to convey to each other signals concerning their operations, led to the invention of the heliograph (*q. v.*), by means of which the rays of light can be converted into active speaking agents.

Applied to military telegraphy, the heliograph may present many advantages over the electric telegraph, as the limit of its range is dependent only on the elevation at which it can be placed. During a siege it can signal over the heads of the besiegers, who cannot intercept it, and is therefore well adapted to replace the electric wires when destroyed, being liable to no interruption from the enemy. In field operations, it may also be used for securing communications between patrols, flanking and reconnoitring parties, advanced and rear guards; and, "in comparison with flags," says Mr. Samuel Good, in his lecture on Mance's heliograph, "it excels in range, speed, ease of manipulation, secrecy, less liability to confusion, and capability of making itself seen."

However, a great objection presents itself to the employment of an instrument the use of which depends entirely on the presence of the sun, especially in a country like England, where the sun does not shine for weeks at a time; and although the heliograph will never supersede or be substituted for other modes of signalling, it may, with great advantage, supplement them.

The code of signals adopted for the heliograph is the Morse, that is, short and long flashes.

*Electric telegraph.*—A mechanical apparatus by means of which messages can be transmitted to any distance through the agency of electro-magnetic wires, according to a recognised code of signals.

The electric telegraph is a new element of war. England was the first to apply it to military operations. During the siege of Sebastopol, telegraphic lines were established by the allied armies, and later, during the Indian mutiny, a first attempt was made to organise a field telegraph, which succeeded admirably, under the direction of the late Captain Stewart, of the Bengal engineers. In 1859, the French army was accompanied by a large *personnel* belonging to the civil telegraphic administration, whose duty was to establish a service during the marches. The war in America, and that between Austria and Prussia in 1866, showed convincingly the importance of such an introduction into military operations. Permanent lines on a large extent were established and worked by the troops; all those that existed in the zone of operations of the armies were seized. Trains of a special field material followed each corps, to be used on the march, in cantonments, and even on the field of battle. In 1866, the Prussian and Austrian armies employed, to a great extent, telegraphic lines during the marches and manœuvres that preceded Sadowa. The war of 1870–1871 is another instance of the immense advantages that can be derived from the use of the electric telegraph, when well organised and employed. During the latter end of the war, Manteuffel and Werder, operating in the east, separately, and on different lines, were able to combine their movements and to receive direct instructions from the head-quarters at Versailles by means of the wire.

The telegraphic department in time of war may be divided into two distinct branches. The first comprehends the seizure and use of all permanent lines existing in the country in which the operations are carried on, or, in the absence of these, the creation of new lines of the same kind. The influence of the telegraph is very great, as it enables the general in command, as long as the opposing armies are concentrated, to transmit intelligence and directions between his head-quarters and the rear of his army, or between himself and the generals commanding wings. The organisation and working of such lines should keep pace with the rapid transport by rail of troops and supplies. Whether already existing or newly created, it is considered as a general rule that, within the zone of operations, an army should exclusively dispose of all the lines indispensable for its correspondence, and that these should be carefully watched over, whilst those that are not necessary, and might fall into the hands of the enemy, should be destroyed.

The second branch of this department comprehends the transport, the establishment, and the working of mobile lines, known as the *field telegraph*. These are used when the opposing armies are in presence of each other, and on an extended front, and in cases when concentrated action is essential to success. By the field telegraph, *corps d'armée* are placed in intimate communication with each other, and are connected with their base of operations by means of the permanent lines. On the march, the telegraph can easily be laid down as each column advances, and thus the commander-in-chief be placed in communication with the whole of his army. In certain cases, when circumstances permit of it, the field telegraph, as was seen during the Indian mutiny and later wars, can be brought on the battle-field, following closely the combatants.

Lines of a light nature can move easily with armies in the field, and can subsequently be replaced by others of a more solid material, called *semi-permanent*, if communication is to be kept up for any length of time. Field, semi-permanent, and permanent telegraphs differ in materials and manner of laying.

The *field telegraph* should be of such a nature that it can be constructed or taken up at the same rate as an infantry regiment marches.

The *semi-permanent* telegraph is constructed of more solid material and substantial wire; its weight, including the poles, should not exceed 1 ton per mile, and it should be of such a nature as to be laid at a rate of from 20 to 30 miles a day for every 100 men employed. The wires are suspended from poles, trees, or in any other convenient mode.

The *permanent telegraph* can be constructed at the rate of 10 miles a day.

There is a point below which the electric telegraph ceases to be advantageous over other modes of communicating intelligence, such as is carried on by signalling and by mounted orderlies. The handing-in, the transmitting, and the receiving of a telegram require a certain amount of time, which may be longer than that necessary for a mounted orderly to cross the distance between the two places. The electric telegraph, therefore, should only be made use of for distances of 8 miles and upwards.

In England, the military telegraph is worked by a branch of the royal engineers, of which there is one troop. At present, this troop is composed of 3 officers and 245 non-commissioned officers and men; 12 wagons, each carrying 3 miles of insulated wire, rolled on 6 drums for paying-out, and iron rods for carrying over roads. A telegraph troop forms 3 sections, composed of 3 travelling offices, 3 general service wagons, and 3 artificers' wagons.

In time of war, this branch of the service would be placed, in each army corps, under the immediate control of a director of telegraphs, with an assistant. His chief duty should be to keep up the communication between corps and divisions and head-quarters. He should never be without one or two alternative lines in case of accidents, and be always prepared to alter and adapt existing lines. Between important points there should be two or more separate lines, remembering that the sole value of telegraphs lies in their security.

Every effort should be made to watch over the telegraphic lines used by an army in the field, and to destroy those of the enemy. Their destruction is easily executed; and this duty generally devolves on cavalry. It is sufficient to pull down the poles, and to cut them in several pieces, or carry away as much of the wire as possible; to destroy the insulators, as well as the instruments and batteries found in telegraphic stations. A non-conducting wire, having the outward appearance of an ordinary wire, can be used also for destroying communication, by splicing it to the electric wire in one or two places along the line. The result will be that all galvanic communication will be stopped, and it will be difficult to discover where the break exists.

In telegraphy, as well as in the other branches of military art, it is important to be acquainted with the resources of the country, and to take as much advantage of these resources as is possible. These are obtained by means of reconnaissances, and note must be taken of the plan and direction of all existing lines, and the advantages that may accrue from them by connecting them with other stations; the number and kind of instruments used in the stations; whether the roads to be traversed by the army are planted with trees or posts, on which the wires can be set up; and whether the neighbouring woods can furnish timber for posts.

**Telemeter** (Greek *tele*, far off; *metron*, a measure)—An instrument for measuring distances; it is also known by the name of *range-finder* (*q. v.*).

Many of these instruments have been invented, and one of the latest is that by Captain Nolan, R.A., which has been introduced into the service, and is known as Nolan's range-finder.

M. Le Boulengé, a Belgian major of artillery, has also recently invented a telemeter, so constructed that, by measuring the intensity of the report of a distant piece of ordnance, it indicates the exact distance between the gun and the observer. It is composed of a glass tube, provided with a graduated scale representing distances, and containing an index, floating in sulphuric ether. The observer, after having previously brought the index to the extremity of the tube that corresponds with the beginning of the scale, places the instrument horizontally in his hand and watches the enemy's position. As soon as he perceives the smoke of a gun, he brings the instrument suddenly in a vertical position, and the index descends along the tube; then, when the report is heard, he reverses the telemeter, and the index remains stationary. The division of the scale on which the index has stopped gives the distance between the gun and the observer.

Besides the above instrument, he has

succeeded in making a telemeter, on the same principle, of such small dimensions and of so compact a form that it can be easily fitted in and carried by any small-arm. It is composed of a small crystal tube, closed at both ends, and filled with rectified benzine. In the tube an ivory index floats, painted red. The instrument is encased in the flat part of the stock of a rifle, perpendicular to the axis of the barrel; a small opening cut in the wood enables the reading of the scale. The mode of using it is very similar to the before mentioned instrument, the rifle being turned instead of the hand.

**Telescope**—An optical instrument. By a proper arrangement of the lenses or glasses in a tube, objects at a great distance are brought near to the eye. The invention of this invaluable instrument is ascribed to Roger Bacon or Baptista Porta.

**Tempering**—In metallurgy, the preparing of metal, especially steel, by plunging it suddenly into cold water, after it has been raised to a high temperature, so as to render it more compact, hard, and firm; or the reverse, more soft and pliant. For special purposes, oil, mercury, and saline solution are also used.

**Templet**—A gauge to indicate the exact measurement of work to be done, and for ascertaining the size of various articles, such as wire, &c. Templets are made of iron, steel, wood, or of such material as is considered most suitable.

**Tenacity**—In a general sense, extreme adhesiveness.

In metal, it is the property it possesses of resisting rupture by traction. It is proportionate to the weight which the wire or rod of a metal, of a given area, is capable of sustaining.

The term tenacity is used when troops hold fast a post with great persistence and bravery.

**Tenaille**—In fortification, a low work in the main ditch before the curtain and between the flanks of the half-bastions of a front of fortification. It is usually 16 yards in thickness, and revetted with masonry all round.

**Tenaille System**—In fortification, a mode devised for preventing the besiegers from approaching too close to the ramparts without being seen. There are three different ways of *preventing* this, viz. by the system adverted to, the bastioned system, and the polygonal or caponier system. Of these three, the tenaille system is the most defective. The trace of this system is an indented or star trace, the rampart being disposed in straight lines, forming with one another alternately salient and re-entering angles, the flank defence being supplied from the re-entering angles, either by means of casemates behind the escarp or from the ramparts.

The disadvantages of this system are —(1) the liability of its faces to enfilade fire; (2) the insecure position of its flank defences when casemated, viz. at the inner end of a long ditch, the prolongation of which can be easily occupied by an enemy; (3) the great length of the ramparts as compared with the space they enclose; and (4) the oblique defence.

**Tenon**—In carpentry, the square end of a piece of wood or metal reduced to one-third of its thickness, which is inserted in a hole in another piece made to receive it, called the mortise, for the jointing or fastening of the two together, and a pin driven through to keep them in place. (*Vide* Mortise and Tenon.)

**Tensile Strength**—As applied to iron, is its power to resist being torn asunder by a force exerted by a breaking instrument in the direction of its length. Cast iron of good quality, such as is used in casting guns, ranges from 14,000 to 17,000 lbs. on the square inch. In experiments made in America, whenever the tensile strength of iron fell below 20,000 lbs. the square inch, the quality was rejected and pronounced bad, and the gun unfit for service. The capacity of cast iron to resist compression is six times greater than its capacity to resist extension.

**Tent**—A covering of canvas for troops in the field. Tents are of various sizes and descriptions; those issued to the British army are *circular tents*. They are 10 feet high; diameter at the base, 12·5 feet, and weight, complete with pole, when dry, 74 lbs. A circular tent holds 15 men.

For the use of the troops in India, a much larger and loftier tent is provided, consisting of a double fly or roof, and a single kanat or wall round it. It holds

16 men, but seldom more than 12 men are put into it in peace-time. Tents are carried either on elephants or camels, or in country carts. Non-commissioned officers are provided with single-pole tents with double fly and single kanat. Tents for officers differ in size. A field officer has a double-pole tent with two flies and two kanats; captains and subalterns have single-pole tents from 12 to 14 feet square, with double flies and double or single kanats. Officers have to find their own tents. Tents for native soldiers in India are termed *pāls* or *pauls*, and are of a smaller and lighter description than those used by the European soldiery. A *pal* weighs 248 lbs.

**Tentes d'abri** (French = shelter-tents)—Small tents used in the French army. They are easily put up and struck. They are carried by the men on their knapsacks, two men to each tent, but they have been found to be a great incumbrance, too much weight being placed on the men's shoulders. A *tente d'abri* consists of 2 sheets about 5 feet 6 inches broad, 2 poles, and 7 pins, and weighs about 11 lbs. when dry; it is issued at the rate of 1 to every 3 men. The sheets, by means of buttonholes, can be converted into bags, or can be joined to other sheets and form a larger tent.

**Terminal Velocity**—Is thus described by Lieutenant-Colonel Owen :—" When a body descends in air from a state of rest, its velocity increases for a time by the action of gravity on it; but since the resistance of the air increases also while the velocity increases, it must at length become equal to the accelerative power of gravity, which is constant; after which the body will move uniformly with the velocity acquired at that time. This is called the *terminal velocity* of the body."*

**Terms, Military**—Certain technical expressions which officers of the army should be acquainted with, and which, directly or indirectly, ought to be used in writing on military matters, or in relating the events of a war.

**Terre-plein**—In fortification, is the part of the rampart not occupied by the guns, and in rear of them; it is from 25 to 40 feet in breadth.

**Territorial Army**—This term is given to an organised military force in France, or *second reserve.* It is designated a special army, having its own numeric classification, its special corps, and its independent organisation. France has really, therefore, two armies, the active and territorial. The former is intended for mobile war in the field; the latter, on the contrary, is charged with the care and defence of fixed points of territory, fortresses, strategic points, coasts, and *Etappen* stations and lines. It will, as a rule, have to operate only in more or less important detachments, while the active army operates in masses. The territorial army will rarely detach bodies of troops to join the active army, and if the law has provided for this detachment, it is only mentioned as an exception. The strength of the territorial army may be said to be always less than half the active army.

At the present time, the name of each individual belonging, according to the last military law, to the territorial army has been entered on local registers, and then distributed (on paper) among the several territorial regiments. Each of the 18 military districts into which France is divided has either 8 or 9 such regiments of infantry, with the exception of the first (Lille corps) district, which has but 7. To provide for the cavalry of the territorial army (the scheme contemplating the separate formation of each arm), returns have been made of the local distribution of all horses in private hands capable of being adapted for the service. In the same manner, the regiments of the territorial artillery, each assigned to one district, will be raised according to specially arranged districts, each to be capable of horsing one regiment of field batteries. A battalion of engineers will be enrolled in each of the regular districts, taken from such men as will be specially fit for it. (*Vide* French Army.)

**Tertiate**—To examine the thickness of metal in ordnance with callipers.

The term " tertiating " is derived from the process originally adopted in measuring the three principal dimensions of a gun, viz. the calibre, the length of the bore, and the thickness of the metal at the breech.

---

* In strictness, a terminal velocity is never *exactly* attained; but in a short time from the *commencement* of the descent, the body acquires a *velocity* which is extremely near being uniform.

**Test**—A proof or examination of anything. In the proof of gunpowder, a *hygrometric test* is taken, which shows the quantity of water in gunpowder after it has been manufactured, and at any period of storage. For testing the tensile strength of metals, a testing machine is used, as shown below.

**Testing Machine**—A machine used for testing the tensile strength of metals; it consists of two levers, one acting on the other in such a manner that any weight applied to the first exerts a strain of 200 times as great on the test specimen.

**Tête-de-pont** (French = bridge-head)—In fortification, a work covering the communication across a river; also termed a bridge-head. Bousmard says a *tête-de-pont* ought to unite the properties of a perfect defence of the river on both sides, to cover the bridge well, with space sufficient to contain the garrison, and to furnish a free passage for a considerable body of troops. The *tête-de-pont* should also be sufficiently strong to resist an assault.

**Thalweg** (German = path of the valley)—A term applied to that line of a stream of water, river, &c. where it runs the swiftest. It follows the lowest part of the valley in which the river flows, hence its name.

**Theatre of War**—The whole area of a country, in any part of which the hostile armies can come into collision with one another.

**Theodolite** (Greek, *theao*, I see; *dolichos*, long)—According to Heather, is a surveying instrument which measures at the same time both the horizontal angles subtended by each two of the points observed with it, and the angles of the elevation of these points from the point of observation. The theodolite, as at present constructed, consists chiefly of a pair of parallel plates, with adjusting screws, fitting on a tripod (similar in construction to the supports to the V and other levels), a horizontal limb for measuring horizontal angles, and a vertical limb for measuring vertical angles.

**Thermometer** (Greek, *thermos*, heat; *metron*, a measure)—An instrument for measuring the degree of sensible heat. The following description is given in Tomlinson's 'Cyclopædia of Useful Arts and Manufactures':—"There are three varieties of this instrument, differing merely in the notation. *Fahrenheit*, whose thermometer is generally used in this country, fixed the zero of his scale at the temperature of a mixture of snow and salt, and divided the interval between this and the boiling-point of water into 212 equal parts or degrees, so that on this scale water freezes at 32°, and there are 180° between its freezing and boiling points. Celsius, in constructing his modification of the thermometer, assumed as the zero of his scale the freezing-point of water, and, proceeding on the decimal principle, divided the interval between this and the boiling-point into 100 equal parts, so that on this scale the point of ebullition is indicated by 100°. Hence, his instrument, which is used extensively on the continent, has been called the *Centigrade*. In *Réaumur's* scale, as in the Centigrade, the freezing-point is the zero; but the distance between the freezing and boiling points is in Réaumur's divided into 80 equal parts, instead of 100, so that on this scale the boiling-point of water is at 80°. In each of these thermometers, the degrees of temperature under the zero are indicated by the sign *minus*. Thus − 15° Fahr. indicates fifteen degrees of that scale below the temperature of a mixture of snow and salt; while the same notation on the Centigrade or Réaumur scale signifies a temperature fifteen degrees of the one or the other of these scales below the freezing-point of water."

The following are the rules for finding each thermometric degree and its equivalent on other scales.

Fahrenheit's scale, one degree equals $\frac{4}{9}$ of one of Réaumur's, and $\frac{5}{9}$ of the Centigrade.

*To convert a degree of Fahrenheit into its equivalent on the Réaumur scale.*—Multiply the number of degrees above and below 32°, or freezing-point, by 4, and divide by 9. *Ex.*—What is the equivalent of 98° Fahrenheit on the Réaumur scale?

$$98 - 32 = 66 \text{ above the freezing-point};$$

$$\frac{66 \times 4}{9} = 29{\cdot}3 \text{ Réaumur.}$$

*To convert a degree of Fahrenheit into* *its equivalent on the Centigrade scale.*—Multiply the degrees in Fahrenheit that are below 32° by 5, and divide by 9. *Ex.*—What is the equivalent of 212° Fahrenheit on the Centigrade scale?

$$212 - 32 = 180;$$

$$\frac{180 \times 5}{9} = 100 \text{ Centigrade.}$$

*To change a Réaumur degree into Fahrenheit.*—Multiply by 9, divide by 4, and add 32.

*To change a Centigrade degree into Fahrenheit.*—Multiply by 9, divide by 5, and add 32.

Fahrenheit's thermometer can be used to ascertain the height of mountains by the following formula:—Let $T$ = temperature of boiling water at any station deducted from 212, and $H$ = height in feet of station above the sea. By boiling some water and ascertaining $T$ by means of a thermometer: $H = 520\,T + T^2$.

**Thimble**—An iron ring attached to the end of drag-ropes, siege and field. The thimble is firmly secured in its place by a spliced eye of rope surrounding its outer circumference.

**Thistle, Order of,** *vide* St. Andrew's, Order of.

**Thorough-pin**—In a horse, is the enlargement between the flexor of the foot and the extensor of the back. It is the result of over-work, but hardly constitutes unsoundness in a horse. It should be treated as for windgall.

**Thread**—A very small twist of flax, wool, cotton, or other fibrous substance. Skeins of *cotton thread*, weighing about 2 oz. each, are used in arsenals and magazines for quick-match, and in a twisted state by sailmakers for sewing.

*Worsted thread* is used in forming the cups of quill tubes; 12 oz. will be sufficient for about 1000 cups. (*Vide* Pack Thread.)

**Throttle-valve**—A valve in the steam pipe of an engine for regulating the supply of steam to the cylinder. In land engines, it is generally connected with the governor.

**Thrush**—A foul discharge issuing from the cleft of a horse's frog, and attended with disorganisation of the horn. It is derived from two causes, either internal disease or bad stable management. Astringent ointments should be applied for its cure.

**Thumb-knot**—A simple knot used to prevent ropes running through blocks when rove, &c.

**Thumb-screw**—A pressure screw; an adjusting screw.

**Thumb-stall**—In artillery, a piece of leather used by the gunner who serves the vent to protect his thumb.

**Tie-beam**—In a roof, is the beam which runs across the breadth of the building, the ends resting on the side walls of the house. Two sloping rafters, called *principals*, are mortised into the tie-beam at their ends by a joint, and to prevent the principal from starting upwards out of the mortise, it is strapped down to the tie-beam by iron straps, bolted or screwed to both timbers.

**Tier Shot,** *vide* Grape Shot.

**Timber**—Wood used for building and other purposes. In England, the following are the different woods used for artillery purposes, which are thus described:—

*Oak* is the strongest, toughest, and most lasting, and hence is used where strength and durability are required, as in the spokes of a wheel. It contains an acid which tends to corrode iron in contact with it.

*Elm* is a very cross-grained tough wood, little liable to splinter, and very durable under constant wet. Hence its use for naves of wheels and ends of ammunition boxes.

*Ash*, a tough wood, and very elastic, which renders it well adapted for shafts, handspikes, felloes, &c. It does not stand exposure well.

*Beech* is a hard, strong wood, but will not stand exposure. Used for fuzes, &c.

The chief foreign woods are African oak, sabicu, teak, mahogany, and pine.

*African oak*, a very durable, hard, close-grained wood; stronger, heavier, and darker than English oak.

*Sabicu*, an exceedingly hard, heavy, and durable wood, and hence it is used for surfaces on which there may be much rubbing, or where durability is an object, and weight not objectionable.

*Teak* possesses great strength, toughness, and durability, but splinters readily.

It contains an oil which preserves iron-work. Used for work sent to foreign stations.

*Mahogany* is strong in all directions, and preserves its shape well.

*Pine* is soft, light, and elastic. Yellow pine is used for the interior fittings of wagons. Yellow *deal*, the produce of the spruce fir, is used for ammunition boxes and the boarding of wagons.

*Larch* is a strong, durable, but knotty timber, and is only used for "uphirs," ladders, &c. (*Vide* 'Treatise on Military Carriages.')

In India, the following are the principal woods used in arsenals and workshops :—

### IN BENGAL.

| Description of Timber. | Localities where produced. |
|---|---|
| Saul, *Shorea robusta* .. .. .. | Oude. |
| Sissoo, *Dalbergia Sissoo* .. .. .. | Oude. |
| Teak, *Tectona grandis* .. .. .. | Burmah. |
| Babool, *Acacia arabica* .. .. .. | Burmah. |

### IN MADRAS.

| Description of Timber. | Localities where produced. |
|---|---|
| Pegu teak, *Tectona grandis* .. | Burmah. |
| Annamallay teak " " .. | Annamallay forest. |
| Malabar teak " " .. | Malabar. |
| Saul, *Shorea robusta* .. .. .. | Burmah and Cuttack. |
| Peddowk, *Petrocarpus Dalbergioclies* .. | Burmah. |
| Rose .. .. .. .. .. | Annamallay. |
| Trincomallie .. .. .. .. | Trincomallie. |
| Peemah, *Lagerstrœmia regina* .. .. | Burmah. |
| Satin, *Swietenia chloroxylon* .. .. | Annamallay and Ceylon. |
| Babool, *Acacia arabica* .. .. .. | All over India. |

### IN BOMBAY.

| Description of Timber. | Localities where produced. |
|---|---|
| Aeen (name given to it at Bombay), *Terminalia glabra* .. .. .. | Coimbatore, teak forests of India and Burmah. |
| Babool, *Acacia arabica* .. .. | Common all over India. |
| Black-wood, *Dalbergia latifolia* .. | Annamallay forest; other parts of India and Burmah. |
| Bendie (the name it is known by at Bombay), *Thespesia populnea* .. | Southern parts of India. Grows best near the coast. |
| Teak, *Tectona grandis* .. .. | Malabar, Burmah. |
| Phunsee (the name it is known by at Bombay), *Corallia integrifolia* .. | Burmah. |

**Timber Hitch**—One of the knots used in moving or lifting ordnance, bridging, &c. It is made by passing the end of the rope round a spar or piece of timber, leading round the standing part, and passing several turns round itself, then hauling taut. It has this advantage, that, as long as the strain is maintained, it never gives way. It is a good fastening for hauling a carriage out of a difficulty.

**Timber, Measurement of,** *vide* Measurement of Timber.

**Timber, Seasoned,** *vide* Seasoned Timber.

**Time Fuze,** *vide* Fuze.

**Time of Flight**—In gunnery, the time a projectile takes in describing *any portion* of the trajectory, reckoned from the moment of discharge, or the whole range.

**Time-expired Men**—Non-commissioned officers and men whose time of service is expired. On their return from foreign service, they are sent to the regimental depot to be discharged.

**Tin**—A white metal approaching silver in lustre. It is found in great abundance in Cornwall and in parts of Europe, in Chili and Mexico, in the peninsula of Malacca, and in the island of Banca. It is very malleable; it fuzes at 442° Fahr., and contracts slightly on consolidation. Its density varies from 7·29 to 7·6, the lightest being the purest metal. It is used as an alloy with copper in forming gun-metal. (*Vide* Block Tin.)

**Tin, Sheet** — Formed by coating metals such as iron and copper with tin, especially thin sheet iron. The iron is first scoured or thoroughly cleaned by means of an acid, and then immersed in melted tin. There are two kinds, single and double tin, differing in thickness and in the quantity of tin with which the iron is coated.

**Tincal**—An impure biborate of soda. Borax (*q. v.*) is prepared from it.

**Tirailleurs** (French = sharpshooters, skirmishers)—An independent body of marksmen, formerly in the French army, when few regiments were armed with rifled arms. They were used sometimes in front of the army to annoy the enemy, sometimes in rear to check his pursuit. The term *tirailleur* is now applied to all troops acting as skirmishers. It appears that *tirailleurs* were first employed in the American army. (*Vide* Skirmishers.)

**Tire,** or **Tyre**—An iron band which encircles a carriage or cart wheel. There are two kinds of tires, viz. the *ring-tire* and *streak-tire*. The former, which is simply a band of iron fastened on without any break, has been universally used, for years past, in the artillery service in India. In the home service, until very lately, the streak-tire, which is fastened upon the wheel in pieces, and not in one continued ring, was the usual pattern; but the ring-tire is now adopted for all wheels not exceeding 3 inches in breadth. The breadth of field carriage tires is 3 inches, and ½ inch thick, that of siege carriages, 6 inches, and ¾ inch thick.

**Title, Regimental**—The distinguishing name given to each regiment in the service. Thus the First Dragoon Guards are called the *King's Dragoon Guards*. In the infantry of the line, there is both a regimental and county title. For instance, the regimental title of the 13th Regiment is the *Prince Albert's Light Infantry*; its county title, *1st Somersetshire*.

**Tobrah**—An Indian term for a horse's leather nose-bag.

**Toggel,** or **Toggle**—A belaying pin. Also a small piece of wood fastened to the end of a string or lanyard serving as a hold to grip by.

**Tombac**—Red brass; an alloy composed of 93 per cent. of copper and 7 per cent. of zinc.

**Tommy Atkins** — A familiar term given by soldiers to their pocket ledger or small account book. The origin of this name arose from every document, paper, &c. being headed, for convenience sake, "I, Tommy Atkins," &c.

**Tonnage**—The amount of space that stores take up on board ship, which is calculated either by weight or by cubic measure, a ton consisting generally of 40 cubic feet; but metals and very heavy articles are estimated by actual weight, without reference to bulk. (*Vide* Measurement of Shipping.)

The following is the mode given in the 'Treatise on Military Carriages' of taking the tonnage of a gun carriage, which is equally applicable to any other article:—

"The movable parts, such as the

wheels, shafts, &c., are taken off, and the body of the carriage laid upon the ground, right side up, or otherwise, as may be most convenient. The length of the longest part is then measured, as a guide for the least length of space which the carriage can occupy, and the width of the widest part for the least width. These dimensions give the size of the rectangular base, upon which the body and the other portions are packed as closely as may be convenient. When packed, the greatest height in feet, multiplied by the length and breadth of the base in feet, gives the number of cubic feet occupied by the carriage, and the product divided by 40 gives the tonnage."

**Tools**—Instruments employed to facilitate the various operations which have to be carried on by hand or by machinery either in wood or metal work.

**Topographical Department** — A department of the War Office under the director of surveys, who is an officer of the royal engineers. It comprises the ordnance survey, which includes the various national surveys and the topographical depot, the collection of maps, plans, descriptive books, and journals of staff officers from all parts of the globe. The officers of the topographical depot keep themselves informed, up to the latest date, on all matters pertaining to their department, so that, on an army taking the field, the general may at once be put in possession of all information about the country to be invaded or occupied.

**Topographical Survey,** *vide* Survey, To.

**Topography** (Greek, *topos*, a place; *grapho*, I describe) — A minute and particular description of the soil and surface of any country.

**Torpedo**—A destructive engine of war, used under the sea for the purpose of destroying ships.

Torpedoes were first used by the Russians in the Baltic in 1854, and subsequently, with great success, by the Americans during the civil war of 1861–1865. The Germans, in 1870, effectually defended their coasts against the French fleet by means of these engines.

Torpedoes, as described by Major Stotherd, R.E., in his work on the subject, are "charges of gunpowder, guncotton, or other explosive agents, of various sizes, up to 2000 lbs. of gunpowder or its equivalent, enclosed in water-tight cases of iron or other material and placed under water at such depths that, by their explosion, they may sink or seriously damage a vessel passing in their vicinity."

The word "torpedo," strictly speaking, is applied more to offensive machines, or such machines as are used in naval warfare, than to those used for defensive purposes in stationary positions, which should properly be called *submarine mines;* at least such was the suggestion of the late Sir John Burgoyne, R.E., in talking of stationary torpedoes.

The latter are placed along a coast for the defence of harbours, estuaries, rivers, or of such sea-shores as are open to an invader and unprotected by any natural or artificial means. They are a safeguard against suprise, as no vessel could pass at night or in a fog through a channel protected by them.

There are two classes of defensive torpedoes, *self-acting* or exploding on a ship coming in contact with them, and *electric torpedoes*, fired by means of an electric current supplied from the shore. The latter present the greatest advantages; for they are the safest to friendly ships, as they are always under the control of the observer in charge of them. By simply detaching the voltaic battery employed to fire them, which may be done by the removal of the connecting plug, they become perfectly harmless, and ships can pass over them with safety, which is not the case with self-exploding torpedoes.

A torpedo of the self-acting class is composed of a hollow iron cone, water-tight, with a ring at its apex, to which the sinker is attached. The lower end of the cone is filled with the explosive agent, the charge varying from 100 to 300 lbs. of gunpowder or its equivalent, while the upper part is left empty for the sake of buoyancy. At the top of the powder is an iron case filled with lime, in which a tube of thin glass containing sulphuric acid is enclosed. An iron rod, moving on a joint, passes through the empty part of the torpedo and some distance above it; at the lower end of this rod is a ring which surrounds the upper part of the glass tube, whilst two horizontal rods or "feelers" are attached rigidly to its upper extremity. When a ship strikes the feelers, the rod is deflected from the perpendicular, the ring breaks the glass tube, and the sulphuric acid, acting chemically on the lime, generates great heat and explodes the powder. *Vide* Addenda, Torpedo.)

The electric torpedo, or submarine mine, in its complete form consists of three parts, the fuze, the charge, and the torpedo case or tank; the shape of the case differs, together with the necessary internal and external arrangement of electric connection and conduction, from that of the self-acting class. As explained in 'Chambers's Encyclopædia,' "two wires are laid along the bottom of the water from the shore, passed through the ring below the cone, and brought in at the top to two knobs on the upper part of the powder-keg. Between these a piece of platinum wire passes through a sensitive cartridge. As soon as the circuit of electricity is completed on shore, the platinum becomes incandescent, and the explosion takes place." When gun-cotton is used as an explosive agent, and this composition is preferred to gunpowder, as it is not affected by being wet, and is three times as effective in its explosive force, the charges are placed in cases, the principal being known as the electro-contact, holding 100 lbs. of gun-cotton. The torpedo is placed at such a depth as to strike the bottom of a ship. The other kind of cases are intended for depths varying from 30 feet to 60 feet and over. An electro-contact is encased in wood to prevent the charge being damaged by striking friendly ships. The mines are retained in position by means of "sinkers," of which there are two descriptions, the *saddle* and *mushroom*, the weights of which depend on the velocity of the current of the stream and the nature of its bed. In connecting-up the mine, the circuit-closer is placed in a jacket, and the electric cables are attached to the circuit-closer and the mine, the main and branch cables as well as the fuze piece being joined together. The cables *are stopped* by moving lines, which are *fastened* by shackles to the mooring chains. Different kinds of cables are used; that known as the *branch cable* is always used in water, and protected by steel or iron wires. The core in all cables consists of a strand conductor of four copper wires, tinned, with a case of vulcanised india-rubber. The fuzes used are either platinum wire or Mr. Abel's tension-fuzes. The battery for firing is Le Clanché's of low internal resistance.

To ascertain the right moment at which to complete the circuit, elaborate observations are necessary from the shore.

Of electric torpedoes for offensive purposes, the best known are the *Harvey*, the *Spar*, and the *Whitehead* (fish); the first named is also used for defensive purposes.

Concerning the rule by which the size of charges may be calculated, only an approximate rule can be given, and until such is fixed, the following may be taken: 500 lbs. of gunpowder up to a depth of 20 feet, 2000 lbs. as maximum charge, to be used at a depth of not less than 40 feet of water. Gun-cotton presents, as an agent for exploding torpedoes, many advantages over gunpowder. A charge of gun-cotton calculated to do the same work as a given charge of gunpowder would only occupy one-fourth to two-fifths of the space; the cost of the torpedo, therefore, would be reduced in proportion, and much labour saved in handling, fixing, or mooring the torpedoes, and the space required for storing them diminished. The amount of buoyancy required to keep torpedoes in place would similarly favour the employment of gun-cotton as a charge. This agent is, besides, not affected by wet, and therefore more certain than gunpowder.

A small kind of torpedo has also been used on land for destroying railway lines, trains, &c. During the Franco-German war of 1870–71, a torpedo was placed by a party of *franc-tireurs* under the rails of a line used by the enemy, and exploded as a train ran over it, causing the entire destruction of the train. Experiments have been carried on lately in Germany with land torpedoes, to be employed for the defence of fortresses or other fortified places. These torpedoes, or *subterranean mines*, are shells 11½ inches long, with a double casing 0·58 inch thick, and containing an explosive charge of 4·4 lbs.

of gunpowder or its equivalent in guncotton. A double row of these, connected by a subterranean electric wire, is placed in the ground over which the enemy is expected to pass. The facility with which these mines can be discovered has, however, prevented their ranking amongst other useful engines of war, but every effort is being made to bring them to perfection for defensive purposes.

The manufacture of torpedoes of the Whitehead class and other government torpedoes, together with the apparatus forming their equipment, is carried on in the Royal Laboratory at Woolwich. The working of torpedoes for defensive purposes is placed under the royal engineers, who go through a special training in that department. (*Vide* Schools, Military.)

**Torrent** — A swift-flowing body of water. (*Vide* River.)

**Torsion**—In mechanics, the twisting or wrenching of a body by the exertion of a lateral force. The effects of torsion are seen in the force exhibited by a weight attached to a wire or metal rod, which is made to revolve several times in the same direction, whereby it becomes twisted, and is then disengaged, in virtue of its elasticity untwining itself, causing the weight to revolve in a contrary direction, the process of untwining continuing until the wire recovers its original position.

**Touch**—A military term, signifying that a man in the ranks is feeling the elbow of the man next to him.

**Touch-hole**—The primitive name for the vent of a gun.

**Toughness**—In metallurgy, denotes the property metal has of resisting extension or fracture by tearing or binding. Copper is an instance of toughness.

**Tour of Duty**—Duty in succession. As defined in the Queen's Regulations, "the tour of duty is to be from the senior downwards.

"The first is the guard of the sovereign;

"2nd. Of members of the royal family;

"3rd. Of viceroys;

"4th. Captain-general or governor of a colony;

"5th. Of the general commanding at home or abroad;

"6th. Divisional duties under arms;

"7th. Brigade or garrison duties under arms;

"8th. Regimental duties under arms;

"9th. Courts-martial;

"10th. Boards or courts of inquiry;

"11th. Working parties;

"12th. Duties of fatigue."

**Tournament** — A military exercise that took its origin from the ancient gladiatory combats, which had for their object the training of the youth of the day in all exercises tending to make them active, athletic, and expert in the art of war. This led to those encounters termed *jousts* in which a couple of knights met each other to test their prowess and gallantry, being clad in armour and using weapons of warfare, such as the sword and lance, as their arms. On this followed the tournament, a gathering held for the purpose of bringing together a number of knights who should have the opportunity of exhibiting before this assembly their skill and valour. In such encounters as were held under the name of tournaments in the middle ages, life was not unfrequently sacrificed; but the knight who slew or disabled his adversary was indemnified against all consequences. In later times, to make the tournament more a field for deeds of strength and prowess than for deadly combat, two sorts of arms were employed, those expressly made for the purpose, viz. lances with blunt heads of iron, and the ordinary arms of warfare with which knights had the opportunity, if permitted, of signalising themselves in more than an ordinary degree. Every knight attending was required to prove his noble birth, or rank, as a title of admission. The competitors were at first proclaimed by the heralds with sound of trumpet; and hence the word *blazonry* (which signifies the correct deciphering of the heraldic symbols on a coat-of-arms), derived by some from the German *blasen*, to blow. Afterwards, when armorial bearings became general, the shield of the knight gave token of his rank and family.

In succeeding centuries, tournaments were graced by the presence of ladies, who distributed the prizes to those knights whose bearing in the encounter stamped them as worthy of recognition;

and we find still later on that the jousts or tournaments were generally held in honour of ladies, every knight being bound to possess, in reality, or in show, a dame of his affections, for whose sake all these deeds of chivalry were supposed to be performed.

**Tourniquet** (French, *tourner*, to turn) —In surgery, a bandage which can be tightened or compressed to any extent. It is chiefly used to stop hæmorrhage in cases of amputation, and is invaluable on the field of battle. In cases of emergency and in the absence of a surgical tourniquet, a silk or cotton handkerchief twisted tight by means of a stick passed through the slack, is a good substitute; a bullet or round stone being placed over the artery.

**Tow**—Flax or hemp ready for spinning. It is used in the manufacture of rope.

**Tower**—A movable engine used in ancient sieges, and of such a height as to place the besiegers, by being thus raised, on a more equal footing with the besieged.

**Tower of London**—In the early days of English history, a powerful fortress, on the left bank of the Thames, subsequently a state prison of mournful associations, and now a repository for small-arms and the jewels of the crown. The reader is referred to Mr. Hepworth Dixon's exhaustive account of the Tower of London for all particulars. The interest in the Tower remains to the present day, and is still associated with the army in having a governor, an officer of distinguished rank and services, placed in charge of it, with a deputy governor.

**Towers, Martello,** *vide* Martello Towers.

**Town-Major**—An officer who regulates the duties of a garrison, such as the detail and supervision of garrison guards, the disposal of prisoners in the garrison guard-room, the roster of officers for garrison duties, the superintendence of military police escorts (a regiment is usually told off weekly for this duty), parole and countersign, hours for retreat, and preparation and issue of garrison orders.

**Trace, To**—In fortification, to mark out on the ground the dimensions of a work. The word *trace* in a general sense is interchangeable with *plan.*

**Traces** — Form an essential part of harness, and are indispensable to the draught. They consist of *lead, wheel,* and *short traces*, and are made of 3-inch white rope, of special manufacture, encased in leather piping, having trace-hooks and trace-links attached.

**Track of Artillery Carriages**—The breadth contained between the two wheels of a carriage, measuring from the outer rim of each wheel. The track of field artillery carriage wheels is 5 feet 2 inches from outside to outside of the tire.

**Traction,** *vide* Angle of Traction.

**Traction Engine**—A steam-engine for pulling heavy weights along an ordinary road at a moderate rate. It was first used on roads in England in 1860. This nature of engine has been found useful in warfare. The Germans reported very favourably of its use in the Franco-German war of 1870–71. It is used for heavy transport in rear of an army.

A large-size engine weighs about 28 tons, travels at the rate of 5 miles an hour, and consumes a ton of coal per day.

**Trail**—In a field carriage, that part of the carriage which rests on the ground when unlimbered, and which is hooked on to the pintail of the limber when limbered up. The beam of the O.P. gun-carriage is made of one block, or of two pieces of timber tabled together; under either circumstances it is termed a *block-trail* carriage. (*Vide* Block-trail.) Since the introduction of iron carriages the block-trail pattern has been abandoned, and the bracket carriage is now the service pattern. The trail of a siege bracket carriage is formed by the extremities of the cheeks which rest on the ground.

**Trail-handle** — A traversing handle attached to the trail of the new field guns sent to India. It is made of iron, T-shaped, and fixed to the trail in such a manner that it can be laid flat on it, when not required, without being unshipped. This handle has been in use with the late Indian artillery batteries for many years past.

**Trail-plate**—The ironwork attached to the end of the trail which includes the trail-plate eye. This eye or loop is fixed in the N.P. carriages, and forms a part of the trail-plate. Swivel loops were formerly used in the Madras carriages, and they are said to have had this advantage, that, if the gun carriage upset, it did not entail the fall of the limber.

**Train**—In a military sense, implies the ordnance, carriages, ammunition, and in fact all the apparatus and implements of war which are required for an army in the field (*vide* Transport of Troops); hence the term *siege train* (*q. v.*), &c.

The term *train* is also used in mining to express the powder laid by the miner for some distance along the ground, up to the charge, and by which means the charge is ignited.

**Trainbands**—A body of men which formerly constituted the militia of London, and from which the 3rd (Buffs) were raised. (*Vide* Militia.)

**Trajectory**—The path described by a projectile in the air or in vacuo. The curve described in passing through the atmosphere is due to three forces—the force of projection, gravity, and the resistance of the air. (*Vide* Appendix F.) In treating on the subject of gunnery, an important point arises, as shown by Lieutenant E. Clayton, R.A., in his prize essay, viz. the relation between the weight of a projectile and its calibre, as this leads on to the subject of lowness of trajectory, in which he shows the advantages of it in the flight of a projectile :—

" (1) On account of greater accuracy.

" (2) On account of harder hitting—for lowness of trajectory means greater velocity, and consequently more energy in the shot.

" (3) On account of the greater distance covered effectively by the projectile—'longueur battue,' as the French term it; that is to say, a projectile with low trajectory passes over a greater distance within the height from the ground reached by the objects fired at, than one with a high trajectory."

**Transit**—In astronomy, the passage of any heavenly body over a larger one, such as planets over the sun. The observation of the transit of Venus (1874) will be familiar to most readers, England and other countries *combining to* carry out the observations in distant parts of the world.

**Transit Instrument**—An instrument for observing the *time* of passage of a celestial object across the meridian. It consists of a telescope attached to a transverse horizontal axis, the ends of which are directed to the east and west points of the horizon.

**Transmission of Intelligence,** *vide* Telegraphy.

**Transom**—In artillery, a stout piece of timber or beam connecting two corresponding parts of a carriage. Wooden siege carriages, formed of two brackets, are connected together by three transoms, but the length of the transoms, which regulates the width of the carriage, varies according to the nature of the gun.

**Transport Carriages,** *vide* Carts, Transport; Vehicles, and Wagon.

**Transport of Troops**—As the name implies, is the carriage of bodies of men, with their baggage and ammunition, as well as all war material, stores, supplies, &c., from one country to another, by land or by sea.

Colonel Graham, in his 'Art of War,' states that, "to organise the means of transport for an army acting at a long distance from its principal magazines, in a country where it is entirely dependent on its own supplies, is a problem difficult of solution." It has been therefore the constant endeavour of military administrators and departments to ensure in time of peace a system that will work well on the declaration of war, and so avoid confusion when troops have to be sent by rail or by any other means into the theatre of operations. Particularly has the supply branch of the army to be attended to, with all its requirements for the transport of food and ammunition from the base of operations to the magazines formed for their reception along the line of communication. In order therefore to facilitate the transport of food, wagons and military carts are attached to all armies, to carry food from the main magazines in rear of the army to the smaller ones some days' march ahead. Carts are also attached to each division, carrying a certain number of days' rations for men and cattle. In the march of an army, two considerations will weigh with the general in command in the transport of his supplies and stores: (1) to prevent the assembling of carts or wagons along the line of march; (2) to prevent them following in too close promixity in rear of the army, and so possibly interfering with the operations of the war, by impeding that rapidity of movement which is essential to success.

Transport may be obtained by four methods:—

1. By water;
2. By rail;
3. By wheel-carriage;
4. By pack animals.

Transport by water is the easiest, cheapest, and best, for heavy weights. England, from her geographical position, is constantly obliged to use this mode of transport, to convey troops and war material to India and her colonies. Ships specially built for that purpose, called transports (*q. v.*), have been for some years past used to convey the relief of European troops between home and abroad. In an enemy's country, rivers and canals are also available for transport purposes, but can be seldom used up to the front of positions. The former afford an easy mode for the transport of stores, particularly when steam can be used; the latter cannot be trusted, as they are liable to get out of order, the locks may be blown up and the water supply at the head can be cut off. The Germans, during the war of 1870–71, used a steam flotilla on the Rhine.

Transport by rail is invaluable within one's own territory, but in an enemy's country no dependence can be placed upon the use of it, as the enemy can tear up the lines at any moment, and thus delay the advance of troops and the despatch of war material and supplies until they can be repaired. When, however, railways can be made available, as was exemplified during the Franco-German war of 1870–71, when the Germans around Paris and other parts of France were able to receive supplies from Germany, their advantages are untold. Transport by rail demands, on account of the large bodies to be moved, and the celerity of the trains, complete security and great regularity in all the operations that precede or follow the movement. These conditions can only be obtained by an exact observation of the rules laid down for that service. (*Vide* Railways.)

Colonel Hamley, in his 'Operations of War,' gives the following on the use of railways for the transport of troops:—

"Whatever advantages good roads can confer must be immensely increased when railways are employed. In using them, the first step must be the collection of the rolling stock on the required points of the different lines. . . . This preliminary measure accomplished, the following conditions attach to the conveyance of troops of all arms:—

"A train of from twenty-four to thirty-four carriages of all kinds—passenger carriages, cattle-trucks, horse-boxes, and break-vans—can be propelled by one engine; and a speed of from twenty to twenty-five miles an hour, though lower than what is attainable, is considered most suitable to a continuous movement, by lessening the risk of breaking down.

"An ordinary second or third class carriage holds thirty-two soldiers. A horse-box holds three horses, and a cattle-truck six to eight. Taking the effective number of one of our infantry battalions at 1066 men and thirty-three officers, the battalion, with its transport and equipment, including fourteen wagons and sixty-five horses, can be conveyed in two trains.

"One train will contain a squadron of cavalry of 120 horses, and four trains the regiment.

"Each artillery wagon, or gun, with its limber, occupies one truck. A battery of horse artillery, or a field battery, with its men, horses, and equipment complete, requires two trains, of from thirty-one to thirty-three carriages each.

"A battalion of infantry standing ready at the station, and properly practised, embarks in a few minutes. Cavalry require twenty-five minutes to fill a train, and artillery half an hour. If all embark at the same station, only three trains could be despatched in an hour. But by creating temporary platforms the loading can take place simultaneously. A platform 300 feet long allows all the carriages of a train to be loaded at once—and such a platform can be made in three hours, by 200 men, out of materials always at hand on railways.

"Under such circumstances, it has been calculated that there would be no difficulty in forwarding, on an English railway, large bodies of troops at the rate of one train every seven and a half minutes, or eight trains per hour—that being the shortest interval judged safe on such occasions. The transport of an English army corps, according to the latest organisation, might therefore be thus calculated in round numbers.

"An English division requires the following:—

| | |
|---|---|
| Infantry, 7 battalions .. .. | 14 trains. |
| Artillery, 2 batteries and ammunition column .. .. | 6 " |
| Cavalry, 1 regiment .. .. | 4 " |
| Staff, engineers, and military police .. .. .. .. .. | 2 " |
| | 26 |

| | |
|---|---|
| 3 infantry divisions .. .. | 78 trains. |
| 1 cavalry brigade (3 regiments, 1 battery) .. .. | 14 " |
| Reserve artillery (6 batteries and ammunition column) .. | 14 " |
| Engineers, telegraph, &c. .. | 4 " |
| Staff and military police .. | 2 " |
| Field hospital and ambulance | 16 " |
| Control and supplies for 3 days | 16 " |
| | 144 |

"Supposing the carriages collected and the platforms made for embarking and disembarking, the corps could be conveyed sixty miles in twenty-one hours from the commencement of the movement. This amount of force might be despatched on our chief railways without aid from return carriages. Other bodies might also follow to the distance named, or even farther, since the carriages would return in time to maintain the continuity of movement. But if the distance were doubled, the operation must be interrupted.

"This calculation rests on data afforded by double lines conducting a great traffic, and *possessing the* maximum amount of officials, servants, and rolling stock."

Wheel transport is the most economical of all, where good roads can be found, and more advantageous in comparison with pack agency, as to the power of bringing up stores. A horse drags five times more than it can carry, on good roads, and therefore a great deduction can be made for the food of these animals. When bullocks are used in draught, they are found to pull better in swampy countries, and have more endurance than any other animals. Camels are not good draught animals; moreover, they are useless in moist or swampy ground.

Pack animals require more men to attend on them, and the further an army gets from its base of operations, the less these animals can carry. They cannot be unloaded at every halt, whereas wagon or cart horses can rest on a halt, however short it may be. Pack animals, though more difficult to load and more liable to sore back and to strains, are found useful when armies have to operate in countries where no roads exist, and where troops may get separated from their wagons. In defiles the breaking down of a wagon may cause serious loss of time, while in cases of blocks pack animals can easily get forward.

Of pack animals, the following are the best fitted for general service:—

1. The mule, which can carry from 200 to 250 lbs. in a level country, and 100 lbs., including pack, in a hilly country, as in Abyssinia.

2. Bullocks, though slow, can carry in level countries 200 lbs., including pack, and have proved that they stand fire well.

3. Camels can carry about 400 lbs. and walk at the rate of 2½ miles an hour.

4. Elephants can travel at the rate of 3 to 3½ miles an hour, and carry from 15 to 20 cwt. on level ground, but only from 10 to 12 cwt. in hilly countries. Elephants can drag and push as well as carry, and are invaluable animals when required for either of these purposes.

Every army has a separate force organised to convey by land stores, ammunition, and rations, wherever a body of troops may be sent. In England this forms the land or military transport.

The transport is one of the civil departments of the army, and is a subdivision of the control department. It is intended to be a nucleus of a system of transport on a large scale for an army in the field. In time of peace, it is employed in the conveyance of baggage and commissariat supplies at the several camps and stations, and also upon the public works, arsenals, &c. Besides the army transport, there is a regimental transport for the conveyance of the camp equipments, light baggage, and regimental ammunition.

When troops move by land, the amount of transport required is calculated by weight; if by ship, by measurement. It is calculated that a 2-horse wagon can draw 800 lbs.; a 4-horse wagon 1800 lbs.; and a 6-horse wagon (G.S. new pattern) 3300 lbs.

**Transports** — Government vessels for the conveyance of troops. The approximate amount of tonnage required for the transport of troops is about 270 tons to every 100 men. (*Vide* Queen's Regulations for the rules and regulations attending the transport of troops, horses, &c.) Under the head of Embarkation will be found information on the embarkation of a battery of artillery. The port of embarkation and debarkation for the relief of troops is, in England, Portsmouth, and in India, Bombay.

**Travelling Allowance**—A certain sum of money granted to officers and military subordinates travelling on duty. It is given to defray the expense of the journey. The scale is laid down in army circular dated April 1, 1872.

**Traverse, To** — In gunnery, a term used when directing a piece of ordnance either to the right or left of the position it is in. In field pieces, mounted on carriages, traversing takes place from the trail. With mortars, it is performed by handspikes in rear and front of the bed, and with siege guns by the application of handspikes to different parts of the carriage. The Armstrong gun has an adjusting wheel screw which enables the pointer to traverse the gun with his own hand and with the greatest accuracy.

**Traverses**—In fortification, are portions of parapet thrown across the covered way on the prolongation of the faces of bastions and ravelins, and at the entrance of the re-entering place of arms; passages or crochets are cut into the glacis, to enable the defender to circulate round the traverses.

**Traversing Handspike**—For traversing the gun, in field carriages, it is inserted into the handspike-ring at the end of the trail, when in action; but when the gun is limbered up, it is strapped on the surface of the trail. There is also a spare handspike carried underneath the trail.

**Traversing Platform,** *vide* Platform, Gun.

**Treadle**—A lever or frame connected by a rod to the crank of a foot lathe, to give motion to the crank shaft; it is pressed down by the left foot of the turner, and raised by the centrifugal force of the fly-wheel or large pulley which is fixed on the shaft.

**Trench Cart,** *vide* Cart, Trench.

**Trench Cavalier** — A high parapet raised upon the glacis for giving a commanding musketry fire, or for throwing hand grenades into the salient places of arms previous to crowning the covered way. This must be commenced by single saps.

**Trenches**—In offensive works and batteries, it is necessary on many occasions to throw up a parapet, from earth excavated in rear of the parapet; such an excavation is termed a *trench*. The usual depth of trenches is 3 feet. Should the nature of the ground be such as not to yield sufficient earth for the parapet, a small ditch must be made in front. In a siege, the approaches made by the besiegers are termed trenches, which are opened at varying distances from the place, depending upon circumstances. (*Vide* Siege.)

**Trestle**—A piece of wood or metal supported by two or four feet joined diagonally; when used in bridging, a fifth leg, on the down side of the river, is sometimes added.

*Trestles*, five in number, and placed at equal intervals, form the cradle in which fascines are made.

**Trestle Bridge**—A bridge supported on trestles. This kind of bridge is very useful in establishing communications across shallow rivers with sound and hard beds, and not subject to sudden floods; it can be readily constructed with any kind of timber, easily placed in shallow water; it is not, however, suitable for deep muddy rivers.

Trestle bridges are of three kinds, the length of the legs depending on the depth of the water. They are described as follows:—

"*Two-legged trestle.*—Made of two transoms, two legs, and two diagonals lashed together; it is used for streams 6 feet deep and running with a velocity of 5 feet per second, or in deeper streams if the velocity is less, and is suitable for any kind of hard bottoms.

"*Four-legged trestle.*—Made of one transom, four legs, and four diagonals lashed together. Used in still waters where a greater length of leg than 12 feet is not required, or in running streams where the water is not more than 3 feet deep, or the velocity greater than 3 feet per second. Another kind of four-legged trestle bridge can be made in the same manner, put together with nails, and is useful for bridges intended to stand for some time, as rope lashings soon rot under water.

"*Tripod trestle.*—Made of one transom, six legs (three on each side, and placed in a triangle lashed at the apex, and fixed together at the basis by ledgers), four cross-bearers to support the transom, and four stakes to support the bearers, the whole lashed together. This kind of bridge is particularly useful for military purposes; it may be used in water 6 feet deep, with a velocity of 5 feet per second, and in streams with muddy bottoms."

**Tret**—An allowance of 4 lbs. in every 104 lbs. weight of goods, to compensate for dust or any foreign matter which may intrude itself into the goods.

**Trews**—The name given to the pantaloons worn by the soldiers of certain Highland regiments. They are made of various tartan cloths. The regiments which wear the kilt do not wear the trews.

**Triangles**—A wooden instrument used at one time in the army, to which soldiers were tied when sentenced to receive corporal punishment. It consisted of three poles fastened together at the top, and which permitted of the legs being stretched out in the shape of a triangle. In each leg there was a spike which kept it firm on the ground; an iron bar, breast high, was fastened across one side *of the triangle.*

**Trigonometrical Survey,** *vide* Survey, To.

**Trigonometry**—The art of measuring triangles, or of calculating the unknown sides of any triangle. It is either plane or spherical.

**Tringle**—A riband or piece of wood nailed on the sides of a traversing platform, to prevent the trucks from running off in the recoil.

**Trip, Cavalry,** *vide* Gabion.

**Tripod Trestle Bridge,** *vide* Trestle Bridge.

**Trituration** — Pulverising the ingredients of gunpowder or any other powder.

**Troop**—In the cavalry, corresponds to a company of infantry, but is of less strength, 60 troopers usually composing a troop of cavalry. Two troops form a squadron.

The term troop is given to the divisions of the royal engineer train.

**Trooper**—The name given either to the horse of a cavalry man or to the cavalry man himself.

**Troops**—Bodies of men placed under military discipline.

**Trot**—The next pace of a horse after the walk. It is about 7·5 miles an hour, or a mile in 8 minutes. A good trotter will do 8½ miles an hour.

**Trough,** *vide* Water Troughs.

**Trough for Hale's Rockets** — This machine has been invented for firing Hale's rockets. It is made of plate-iron, and is supported on two short legs in rear and a tripod in front. On the front one runs a gun-metal ring, connected by two bars with a V near the front of the trough; the elevation is given by sliding the ring up and down the front leg (which is graduated to the required degree), and clamping it. There is an arrangement at the rear end of the trough by which the rockets may be fired with a friction tube.

**Trous-de-loup,** *vide* Military Pits.

**Truce**—A suspension of hostilities for the purpose either of parleying, burying the dead after a battle, or any other purpose thought fit by the commanders of the opposing forces. Such a truce may be termed partial or temporary. A truce, or general armistice, for the termination of hostilities, or for the purpose of carrying out some important object in which both sides are interested—such as the armistice offered by Germany to France for 25 days to carry out the election of the constituent assemblies, but which was refused by France—requires the ratification of the sovereign power or generals having full power to execute.

A *flag of truce* is sometimes sent from the enemy when he has anything important to communicate; the person bearing it is to be treated with attention and civility; but as communications of that nature are frequently designed for the purpose of gaining intelligence and of reconnoitring the army and its outposts, the most strict and efficacious means are to be adopted to frustrate such intentions.

**Truck Carriage**—An inferior kind of platform wagon. It is used for carrying ordnance and heavy boxes for short distances; for taking guns through the passages or sally-ports in which there are no short turnings. There are three sizes of truck carriages, large, medium, and small. Guns are mounted on them and lashed in the same manner as on sledges. This carriage goes under another name in ordnance nomenclature.

**Trucks**—Small iron wheels attached to garrison standing carriages; wooden or copper ones to ship carriages.

**Trumpet**—A wind instrument, made usually of brass, and used by the cavalry and artillery for sounding the various calls of these regiments.

**Truncated Cone**—The frustrum of a cone, the top of which is cut off by a plane parallel to its base.

**Trunnion Gauge,** *vide* Gauge, Trunnion.

**Trunnion Holes**—A cavity made in the upper part of the gun carriage brackets to receive the trunnions. Siege carriages have travelling trunnion holes as well as firing holes.

**Trunnion Sights**—Sights placed on the trunnions of rifled guns for laying the gun. There are two kinds used with B.L.R. ordnance, viz. *drop-sights* and *screwed-in sights.* The drop-sight consists of a gun-metal socket, collar, and pillar, and a steel leaf. The screwed-in sight is made of steel, and is screwed into the sides of the trunnion pieces, with the exception of those for the 40-pr. (new pattern) and 9-pr. guns, the trunnion sights of which are made of gun-metal studs, slipped and locked into sockets fitted in the guns for their reception, and the top of the studs are not finished until after they are fixed on the gun.

The solid steel trunnion sights are fixed or removed by the double-ended spanner of the smith's tools. The trunnion sights of the new 40-pr. and 9-pr. guns can be removed or fixed at a moment's notice by simply raising the brass collar, giving the sight a quarter turn from left to right to release the stop from the recess in the bottom of the socket, and lifting it out. The trunnion sight used with M.L.R. guns is a drop-sight. (*Vide* Sights.)

**Trunnion Square** — An instrument used for ascertaining the position of the trunnions in relation to the axis of the bore. It has a movable wrench and sliding point.

**Trunnioning Machine**—A turning lathe in which the trunnions for ordnance are turned. The piece is secured in the turning lathe by two centres which are made to press against the extremities of the trunnions, and while a rotatory motion is communicated to the gun about the axis of these trunnions, they are turned by cutters pressed against them.

**Trunnions**—In artillery, two solid cylindrical pieces of metal by which a gun is supported on its carriage in the trunnion holes, and on which it moves as on an axis, so as to admit of any required elevation being given to it. Trunnions of S.B. guns were cast at one time with their axis a little below the axis of the piece, and at right angles to it, but more commonly with their axis in the same plane with that of the piece. They should be of equal diameter, and about one calibre in diameter and length. In all rifled guns and in howitzers, the axis of the trunnions passes through the axis of the piece. The trunnions of a mortar are cast on to the breech, this being a convenient position as regards the mounting of the mortar on its bed for firing at high angles.

**Trussing**—In carpentry, is the mode of strengthening any beam which is long in proportion to its breadth and thickness, and which is incapable of supporting much additional load. It is a mode adopted in strengthening the girders for floors.

**Tube, Electric,** *vide* Electric Tube.

**Tubes,** *vide* Friction Tubes.

**Tucked-up**—A term given to a horse out of condition, and whose flesh has shrunk away from his flanks.

**Tugs**—Straps used in shaft harness for keeping up the shafts.

**Tullub**—An Indian term signifying a demand, but it is commonly used amongst the natives of India when speaking of their monthly pay.

**Tumbler**—One of the limbs of a musket lock.

**Tumbrils**—Covered carts, used for a variety of military purposes.

**Turcos**—Native infantry of Algeria, in the pay of the French government, and partly officered by Frenchmen.

**Turkish Army**—One of the armies of Europe.

By a law passed in 1869, the military service is compulsory for all Mussulmans of the empire, and is carried out either by recruiting or by ballot. By subsequent regulations issued in 1871, but not carried fully into effect, the length of service is of twenty years' duration, viz. 4 in the active army (*nizam*); 2 in the first reserve (*idatyal*); 6 in the second reserve (*redif*), and 8 in the *Landsturm* or sedentary troops (*hiyade*).

Turkey has a population of 33 million of inhabitants (without counting Roumania and Servia), 18 millions of which are Mussulmans. Of these, about 3 millions are nomad tribes not amenable to the conscription; another million is to be deducted for the citizens of Constantinople and other cities who manage to evade it. The remaining 15 millions are composed of non-Mussulmans—Christians, Jews, &c.—who are not liable to serve in the army, on paying a contribution, known as the *bédel*, amounting to about 1s. 2d. per head of population. It leaves, thus, about 12 millions to bear the whole burden of the conscription.

The Turkish forces are divided into the regular army, irregular and auxiliary troops. By this new law the military forces are put down at 700,000 men, the active army furnishing 150,000, the first reserve 70,000, and the second reserve and the *Landsturm* 420,000, but, owing to the defective manner of calling out the annual contingent, *nearly* three-eighths are wanting to the present regular army.

The *regular army* is divided into 7 corps, comprising 7 regiments of the guards, 36 regiments of infantry of the line, 2 regiments of Bosnians, 1 regiment from the Greek frontier, another from the Servian frontier, 3 regiments of riflemen, and 2 battalions of Herzegovinians. Each regiment is composed of 4 battalions of 8 companies each.

The cavalry is divided into 7 regiments of the guards, 17 regiments of the line, besides 1 mounted on camels and 2 independent squadrons.

The infantry is for the greater part armed with Snider and Henry-Martini rifles; the cavalry with revolvers and Winchester carbines.

The artillery consists of 6 regiments of field artillery of 12 batteries each (3 horse and 9 field batteries), and 1 regiment of reserve artillery of 3 batteries. Each battery has 6 guns, giving a total of 450 guns. There are besides 4 regiments of fortress artillery and 2 regiments of engineers. The guns of the horse artillery are 4-prs.; those of the field batteries 6-prs., all Krupp breech-loaders. The mountain guns are Whitworths.

The *irregular troops* are composed of 16 regiments of *gendarmerie*, of *bashi-bazoucks*, of volunteers (*spahis*, *Bedouins*), giving a total of nearly 87,000 men.

The *auxiliary troops* form the contingents supplied by Albania, Bosnia, Egypt, Tunis, and Tripoli.

The total military forces of Turkey exclusive of the *Landsturm* and the guards, were estimated as follows at the end of 1875:—

| | War footing. | Peace footing. |
|---|---|---|
| Infantry .. | 117,360 | 100,800 |
| Cavalry .. .. | 22,416 | 17,280 |
| Field artillery .. | 7,800 | 7,800 |
| Fortress artillery | 5,200 | 5,200 |
| Engineers .. | 1,600 | 1,600 |
| Detached corps .. | 16,000 | 16,000 |
| Active army .. | 170,376 | 148,680 |
| First reserve | 105,600 | |
| Second reserve | 24,000 | |
| Irregulars .. | 87,000 | |
| Auxiliaries .. | 75,000 | |
| | 461,976 men. | |

The commander-in-chief is the sultan, and his deputy the grand vizier. All the branches of military administration are concentrated in the war office under a general military council. (*Vide* Appendix C.)

**Turk's-head Brush**—A brush made use of in cleaning the bore of guns.

**Turner**—A mechanic whose business is to shape wood, metal, and other hard substances into round or oval figures, by means of a machine called a lathe.

**Turnery**—The art of forming wood or metal into a cylindrical or other shape; articles turned by a lathe. In turning, the work is usually put into the lathe, and made to revolve with a circular motion about a fixed line or axis; it is worked to the intended form by means of edge-tools presented to it, and held down upon a fixed rest. The projecting parts of the work are thus brought up against the cutting edge, and are cut off, whereby the outer surface is so reduced as to be at an equal distance from the axis of motion, and thus it presents a circular figure. If the axis be made movable during the revolution of the work, we may have oval and rose-engine turning.

**Turning Movement**—The movement of an army, or part of an army, for the purpose of turning or out-flanking one or both wings of the enemy.

Since the introduction of arms of precision, this kind of manœuvre has been frequently used, as it is impossible, without great slaughter, for an army to approach certain positions under the powerful fire of the new breech-loading rifles and ordnance. Generals prefer to hazard the loss of their communications to the certain losses of the assault. Turning movements, being performed beyond the range of artillery, are necessarily very extensive, and their general use is not so much to attack the enemy's flank as to draw him from a position impregnable in front, by threatening his weak side or his rear. (*Vide* Flank Movement.)

**Turning Ordnance**—An operation applied to all ordnance, and performed in S.B. guns at the time the piece is being bored (*vide* Boring Machine), cutting instruments being applied to the exterior of the gun, which is turned down to the proper size. That portion of the gun situated between the trunnions cannot be so removed; it is therefore taken off in a planing machine, in which the piece moves backward and forward under the cutter. Such portions of the surface as cannot be reached by these two machines are removed by the chisel. With rifled ordnance built up according to the Woolwich pattern, the operation of turning is applied to many parts of the gun, commencing after the first coil has been put on.

**Turn-table**—A circular plate of metal carrying rails of the same gauge and on the same level as the adjoining rails. The plate is movable on a central pivot, supported underneath, at different intervals, and near the circumference, by small wheels. It is placed at the crossing of one or more lines of rail, and on the engine or carriage being placed upon it, the plate is moved round in the direction required. Turn-tables of a modified form are used in the service of heavy guns, such as the 10-inch, 11-inch, and 12-inch guns, and perform the part of rotatory platforms.

**Turpentine**, *vide* Spirit of Turpentine.

**Tutenag**—An alloy of 8 parts of copper, 3 of nickel, and 6½ of zinc. It is a very hard, fusible alloy, not easily rolled, and is best adapted for casting. It sometimes contains a small proportion of iron.

**Tuyere**—A blast pipe.

**Twist**—The spiral turn given to the grooves of a rifled gun round the inner surface of the barrel. (*Vide* Gaining Twist.)

**Twisting**, *vide* Torsion.

**Two Half-hitches Knot**—A common knot used in splicing and spar lashing.

**Tyler's Sheet Iron Gabion**, *vide* Gabion.

# U.

**Ubique** (Latin = everywhere) — The motto of the royal artillery and royal engineer regiments.

**Uchatius Gun,** *vide* Steel-bronze Gun.

**Uhlan**—A lancer of the German army. This is said to be a Polish word. This class of cavalry gained a name for the manner in which it carried out light cavalry duties during the war of 1870–71.

**Ultimatum**—In diplomacy, the final condition offered by one government, or its representative, for the settlement of its disputes with another, or in the case of any unusual disturbance or loss experienced by friendly subjects from the riotous conduct of the inhabitants of a country. Also a demand made for reparation, which, if not acceded to within a certain time, necessitates the withdrawal of the ambassador, and a declaration of war ensues.

**Unattached List**—In the British army, officers not attached to regiments. In India, when the services of soldiers in the ranks are transferred from regimental to staff employ, their names are placed on a separate list (the unattached list), which removes them altogether from their regiments. If, for any reason, a soldier is sent back to his regiment, he resumes the rank he originally held in it, unless he has been reduced to the ranks by sentence of a court-martial. All men attached to the ordnance or commissariat departments in that country are placed on the unattached list.

**Uncap, To**—The act of taking off the cap of a fuze. In Boxer's fuze, the cap is made of tinfoil, covered in most of the M.L. fuzes by a copper stripe covering the priming, while the B.L. fuzes are protected by cardboard and copper discs covering the escape holes. Underneath the cap is a small disc of cardboard, to which a piece of tape is attached; this tape is allowed, when the cap is put on, to hang outside the fuze, having a knot at the end. When the fuze is required to be used, the tape is taken hold of, and with a slight jerk the cap is freed from it.

**Unconditional** — Surrendering at discretion; not limited by any terms or stipulations; hence the expression, *unconditional surrender*.

**Unconquered**—Undefeated; not subdued, not overcome.

**Undaunted**—Not depressed or appalled by fear; valiant, courageous.

**Under** — In subjection to; a prefix used with certain words, which renders them self-explanatory.

For instance, in military affairs, *under arms* means that a regiment or body of troops is assembled fully armed and accoutred on parade.

*Under cover.*—Protected from the fire of the enemy by natural or artificial means, or, indeed, in any position out of danger.

*Under fire.*—To be in action, and exposed to the enemy's fire.

**Undermine, To** — To dig beneath a wall or any such support, with the view to its fall. This can be aided by gunpowder or some other combustible.

**Undisciplined**—As applied to troops, not perfect in exercise or manœuvres.

**Unfix, To**—To take off. The word used when the command is given to *unfix bayonets*, on receiving which the soldier detaches his bayonet from the musket and returns it to the scabbard.

**Uniform**—The dress of an officer or soldier on or off parade or on duty. Captain Knowles, in his 'Handy Dictionary of Military Terms,' shows that the dress of a soldier is so called because all men of the same rank and performing the same duties in a regiment are clothed in a uniform manner. It appears that, however ancient the custom of clothing in some distinguishing manner the soldiers of nations is allowed to be, it is impossible to trace the first adoption of military uniform beyond the eleventh century.

During the march of the Crusaders to Constantinople and into Palestine, the Western nations first adopted the use of rich garments, which they wore over their armour. The Saracens also wore tunics, or close garments, over their armour, of plain or striped stuff, which custom was followed by the Crusaders.

**Uniform Twist**—The angle of twist in the bore of a rifled gun; it is the same or uniform throughout the length of the barrel. (*Vide* Gaining Twist.)

**Uniformity**—Resemblance of one thing to another; conformity to one pattern, rule, or order. The term as applied to gunpowder is well known to all manufacturers of that compound, uniformity of manufacture being the great object to attain. Private manufacturers have to take as their standard in making gunpowder on contract for the government that which is made at the Royal Gunpowder Manufactory, Waltham Abbey, which exhibits great uniformity in its strength, &c. and therefore forms a good sample powder to follow.

**Union Jack** — The national flag of Great Britain and Ireland. The ancient English flag was the banner of St. George; on the union of Scotland with England, the banner of St. Andrew was added; and on the union with Ireland, that of St. Patrick—of which three the union jack was composed. It now consists of the red cross of St. George, and a red and white diagonal cross, the last two being side by side. The whole is on a blue ground.

**Unit** (Latin, *unitas*)—In arithmetic, the number one. Euclid defines number to be a multitude or collection of units. In military organisation, the term unit is applied to that single portion upon which any part of an army, regiment, &c. is formed. Thus a company is the unit of a regiment; a battery, that of a brigade of artillery.

**United States Army** — By the first article of the constitution of the United States, congress was empowered to raise and support an army, and the president was appointed commander-in-chief; but by subsequent acts, the number of land forces constituting the standing army of the United States was strictly limited, and in the year 1875 it was enacted that no more than 25,000 enlisted men should be called upon to serve at any one time.

The term of enlistment is 5 years. The army is composed of 10 regiments of cavalry, consisting each of 12 squadrons; 25 regiments of infantry, of 10 companies each; 5 regiments of artillery, of 12 batteries each, and 1 battalion of engineers; 2 regiments of cavalry and 2 of infantry are composed of negroes, commanded by white officers.

The territory of the United States is divided for military purposes into 11 departments, and these are grouped into 4 military divisions.

Besides the regular army, the land force of America consists of a militia for each of the states; it is composed of all men, with a few exemptions, capable of bearing arms from the age of 18 to 45.

**Universal** (Latin, *universalis*, belonging to the whole) — This term, in military matters, is applied to certain stores of a general pattern, such as the saddlery and harness now in use in the army.

**Unlimber, To** — To disconnect the limber from the gun or carriage. It is performed with light field carriages by two of the gunners, sometimes assisted by a third, taking hold of the trail handles and lifting the trail off the pintail hook.

**Unload, To**—The opposite of loading; in a musket or piece of ordnance, to withdraw the charge.

**Unserviceable**—The term is applied in military affairs to all stores which are no longer of use, being either obsolete or worn out.

**Unspike, To**—To extract a spike from a gun; it can be performed by one of the following methods. Lay a leader of quick-match along the bore, and fire a full charge double-shotted; or ram junk wads over the charge, laying quick-match also along the bore, in a strip of wood with a groove on the under side. Or take out some of the metal at the upper orifice of the vent by pouring nitric acid into the groove for some hours before firing. If by this latter method, several times repeated, the action is not successful, unscrew the vent piece, or drill a new vent.

**Usages of War**—Certain practices or customs in time of war acknowledged by all civilised nations, although not specified by any code of laws. These usages, or *rights of war*, have been gradually introduced as civilisation progressed, in order to assuage the horrors of war; some have changed their character, new ones have sprung up as they were needed; others have become as strong as acts of parliament, and have been considered as binding by governments and generals. The Geneva Convention (*q. v.*) is an example of the good done to alleviate the horrors of war.

Prisoners of war (*q. v.*), instead of being put to death, or sent to the galleys as slaves, are nowadays treated with the greatest humanity possible, their exchange having become almost obligatory, and quarter is granted in battle whenever it is sought. These usages are also prevalent with regard to the capitulation of fortified places, or with bodies of troops unable to defend themselves any longer against superior forces. Pillage, also, is considered by some nations as unworthy of a civilised and well disciplined army, and generals enjoin that the civil and inoffensive population of the invaded country and their private property should be respected under penalty of death. Usages of war, however, depend entirely on circumstances, and on the humanity of the general waging war, as no general is bound to abide by them if he thinks necessary to act otherwise in order to gain success. It has been a custom prevalent for years past to summon a town before its bombardment, so as to enable the non-military part of the population to withdraw; but a general can put aside this custom—as was the case with Paris during the war of 1870-71, which was bombarded without any previous warning—if he thinks that, by so doing, he can force the civil part of the population to press on the garrison to capitulate, or he can starve the town by keeping within it as many mouths as possible.

The immunity of private property on land is also of a qualified nature, depending on circumstances. The property of the government of the vanquished state belongs to the victorious army; and although private rights are said to remain unaffected by conquest, generals have, to facilitate military operations, or without any excuse, laid waste the enemy's territory and requisitioned money, food, &c. for the support of the invading army. The regular military and naval forces of a nation, or others called out by government for the defence of the state, are entitled to be considered as belligerents, and are entitled to all the immunities granted by usages of war; but irregular bands of marauders are denied these rights, are treated as banditti, and shot when and wherever found in arms. The rights of war have been extended by some to all persons spontaneously defending themselves and their property in case of necessity; but this distinction is generally observed to suit the belligerent's purpose, for all private citizens taking up arms, although in obedience to proclamation, are constantly liable to be treated as marauders.

The non-compliance with these usages leads generally to reprisals, the worst form of warfare.

## V.

**Vacuum**—Empty space from which all atmospheric influence has been withdrawn; thus, the air exhausted from under a receiver by an air-pump causes a *vacuum*.

**Valise**—A cylindrical case covered with cloth, which is used in the mounted branches of the service to carry the kit of the soldier. It is placed behind the cantle of a mounted man's saddle. In the artillery service, it contains the driver's kit. There is a valise, used by officers on service, which, when open, forms a bed, and contains the necessary rough outfit for the field. The total weight with contents is about 40 lbs; when packed, it is 13 inches in diameter and 28 inches long.

**Valour**—Bravery, courage, intrepidity. It is thus defined by James, in his 'Dictionary':—"A generous quality, which, far from assuming brutality and violence, withholds the fury of the soldier, protects helpless women, innocent infants, and hoary age. Nothing which is incapable of resistance can ever be the object whereon true valour would exercise its prowess. Courage is that grandeur of soul which prompts us to sacrifice all personal advantages, and even the preservation of our beings, to a love of doing our duty. The exercise of this determined courage in the profession of arms is called *valour*. It is composed of bravery, reason, and force: by bravery, we understand that lively ardour which fires us for the combat; reason points out to us the method of conducting it with justice and prudence; and force is necessary for the execution. It is bravery which animates the heart, reason springs from the soul, and force depends upon the body. Without bravery, we fear obstacles, danger, and death; without reason, courage would have no legitimate view; and without force, it would be useless: these three qualities should concur to form true military valour."

The work quoted from enlarges on the subject of valour, and gives the thoughts of past writers on this manly quality, which, though interesting, would occupy more space than can be given in this work.

In our own army, repeated acts of valour have been recorded, with which the reader of military history is doubtless acquainted; and such is the appreciation of bravery by both sovereign and country that the decoration of the Victoria Cross has been specially instituted as a reward for valour.

**Valve** — In hydraulics, &c. a lid or cover of a tube or vessel which is so contrived that it shall open by excess of pressure in only one direction, to permit a fluid or gas to pass; as soon as the excess of pressure is removed, it again closes and prevents its return.

**Vambrace** — That part of ancient armour known as the brassard; it protected the arm below the elbow.

**Van**—The front of an army; the first line, *vanguard.* The troops marching in the front of an army.

**Vanguard**—The advanced guard (*q. v.*) of an army.

**Varnish**—A solution of resin, or of a gum resin, in a liquid, which, when spread thinly over a solid surface, evaporates, and leaves the solid in the form of a brilliant, transparent film. The principal substances used in varnishes are the following:—

| Solvents. | Solids. | Colours. |
|---|---|---|
| Oil of nuts | Amber | Gamboge, annatto. |
| Oil of linseed<br>Oil of turpentine | Anime<br>Copal | Dragon's blood, a deep reddish-brown. |
| Oil of rosemary | Lac | Aloes, cochineal. |
| Alcohol ether | Sandarac<br>Mastic | Saffron, indigo. |
| Wood naphtha, or pyroligneous ether | Dammer<br>Common resin | Turmeric. |

The resins, or, as the varnish maker calls them, gums, may be used either singly or combined, and the same remark applies to the solvents. One of the most desirable qualities in a varnish is durability, a quality which depends greatly on the comparative insolubility of the resin employed, its hardness, toughness, and permanence of colour. The following is a good varnish for polished ironwork, tools, &c.:—

| | |
|---|---|
| Spirit of turpentine | 4 lbs. |
| Dammer | 1 lb. |

It is made as follows. Put the spirit

of turpentine into a large bottle, pound the dammer very fine, and pour it gradually into the bottle, keeping the composition at intervals well stirred. When all the dammer is well mixed, place the bottle in the sun for 3 or 4 hours, and when thoroughly amalgamated, the composition is fit for use. Apply lightly; the varnish quickly dries, and is almost imperceptible.

*To keep Rust from Iron.*

| | |
|---|---|
| Pure grease.. .. | 6 lbs. |
| Rosin .. .. | 2 „ |

Pound the rosin fine, boil the grease, and after skimming it from any impurities, mix the rosin well with it, then cool the mixture, and apply it to your iron work.

**Vat**—A kind of cask; a vessel or cistern for holding fluids. The vessels in which hides are steeped in tan are called vats.

**Vavasseur Gun**—A steel gun invented by Mr. Vavasseur, the successor of the late Captain Blakeley, R.A. The peculiarity of this gun is that it is ribbed and not grooved. It is described as "constructed with a steel tube, but the body is likewise of steel, built up. The gun is, therefore, 'homogeneous.' So far as this property goes, it is possessed by every gun which has the same metal throughout. The suitability of the metal to perform the duty required of it is another question. The inner tube of the Vavasseur gun is inclosed, from breech to trunnions, by a long jacket of steel, shrunk on, and constituting a continuous reinforce. This is in turn reinforced by steel bands shrunk on, in one or two layers, according to the calibre of the piece. The chase of his large guns is also reinforced in like manner. The jacket is shrunk on lightly, the outer hoops at a greater tension. Captain Simpson, U.S.N., highly approves of the Vavasseur gun, as being perfect in theory and successful in practice."

From the experiments carried out at Bourges in 1873 under a special committee, the result, in comparison with the Woolwich gun (a 9-pr.), was most satisfactory. The trial was made under the following circumstances. The charge for both guns was the same, viz. 2 lbs. The shells fired by the Vavasseur gun were Woolwich shells *altered to fit* the ribs of the Vavasseur gun, which was done by grooving the shells. The result was that, at all elevations up to $25^{c}$, the range, mean difference of range, mean reduced deflection, mean variation in height, and probable number of shells per 1000 which would strike a target 6·56 feet high and of unlimited breadth, were all in favour of the Vavasseur gun.

The alterations made in the Woolwich shell, as shown above, gave it an increased range, which gradually increased from 60 yards at 5° elevation to 207 yards at 25° elevation. The initial velocity being very nearly the same in both guns, the increased range in the Vavasseur gun is due to the less resistance of the air to the motion of the projectiles, which, instead of having projecting studs, have grooves sunk in them.

On comparing the practice made on other points, it is shown in the report that the rib-rifled gun, while maintaining its superiority as regards accuracy in direction, becomes as accurate as and even slightly more so, in range and in height, than the Woolwich gun.

*The rib system is therefore stated by the committee to be superior to the groove system from a ballistic point of view.*

Mr. Vavasseur's gun factory is situated in Southwark, where steel and other guns are manufactured.

**Vedette** (French, from Latin *video*, I see)—A mounted sentry detached from a picket. Vedettes are placed about 100 yards in advance of the outposts of an army, to keep constant watch over the movements of the enemy, and to signal to the rear on the approach of danger. The duties of vedettes are thus described:—"The vedettes or sentinels on outposts are to be placed so that they can best observe the approach of the enemy, and communicate by signal to their respective posts, as well as to each other; at night, or in thick weather, they are to be doubled."

**Vehicles**—Under this head are classed the carts usually used in the transport of stores, &c. on service. Country carts or wagons, if procurable, form good carriage, either 2-wheel or 4-wheel. The 2-wheel cart is much recommended for the following reasons:—

The horses are nearer the load, and

therefore the draught is easier; by the position of the horses, they are more under control. There are other advantages in this nature of cart, viz.: one kind of wheel; more easily extricated in heavy ground; carries more in proportion; goes over more ground. There is a 2-wheel cart in the service known as the Maltese cart (*q. v.*), which appears to be a useful kind of cart. It can be fitted in various ways, and can be drawn by mules.

A 4-wheel cart or wagon has the following advantage:—

It allows a more mixed description of animals, and takes up less room on column of march. Wheels can be made of the same size (equirotal). If one horse breaks down, the other three can work.

The general service wagon is drawn by four horses, and has equirotal wheels. The weight of the present wagon is 16 cwt. A new pattern has been introduced, weighing 23 cwt. (*Vide* Wagon.)

**Velocity** (Latin, *velocitas*, speed)—The rate of motion of a particle at any instant of time is called its "velocity" at that instant. The velocity of a particle moving uniformly is measured by the distance passed over in any assumed unit of time; and the velocity at any proposed instant of a particle in variable motion is measured by the distance which would be passed over in an unit of time, if the motion from that instant were to continue uniform during the unit of time.

In gunnery, the velocity of spherical and elongated projectiles is determined, nowadays, with instruments termed chronographs and chronoscopes (*q. v.*), enabling the operator to calculate the resistance of the air to such projectiles, either at the muzzle of the gun or at any point of their flight. From the observations taken with these beautiful instruments, all ballistic problems can be solved. With Captain A. Noble's chronograph, the velocity of the shot along the bore of a gun can be calculated to the millionth part of a second, from the first moment it is set in motion.

The following is the description of the above instrument:—"It consists of a *number of* wheels, or rather disks, re*volving at* a high speed all on the same axis, and these wheels are covered with a coating of soot or lamp-black. Connected with each of the wheels, which are, say, half a dozen in number, is an insulated wire, and these wires lead to six rings inserted in the tube of the gun at certain intervals or stations. The gun is loaded in the ordinary manner, and, when fired, the projectile passes on its way to the muzzle through these rings one after the other, and in so doing presses them down, and in each case cuts through the electric wires with which they are severally connected. If we suppose now that there is an electric current passing along these wires at the time, this sudden cutting by the rings will instantly have the effect of sending an electric spark along the wires to fall upon the rapidly revolving wheels, the place where the spark touches the blackened surface being shown by a tiny clean spot. Thus, if we stopped the apparatus, we should find six of these little marks upon the six different wheels, and the intervals between the spots would show the interval of time that the shot was passing from one station to another. The determination of this interval is merely a matter for calculation, but, obviously, if it is shown that the shot increases gradually in speed, and does not attain its maximum velocity at once, then there has been comparatively little strain imposed upon the gun. And the aim of those charged with the care of the big Woolwich gun is to secure just this result by choosing the most suitable kind of gunpowder for the purpose."

Lieutenant H. Watkin, R.A., has invented an instrument for measuring minute portions of time, which is so highly approved of that it will probably be adopted for ascertaining and recording the velocities at gunnery experiments. The following is a description of this instrument. "It consists of two upright cylinders of brass covered with lamp-black. Between these a weight is made to fall, and electric currents may pass by its means from one cylinder to the other. The shot in passing through a screen breaks the circuit, and causes a spark to pass through the weight, and burn away a speck of the lamp-black on the cylinder. The electric current, however, is immediately re-established by an ingenious arrangement, and the shot, in passing a second screen, or any number of successive screens, repeats the process. The distances between the spots of the cylinder are read off on a scale, and give the time represented to the nine-billionth part of a second."

**Velocity, Angular,** *vide* Angular Velocity.

**Velocity of Rotation,** *vide* Rotation, Velocity of.

**Velocity of Sound,** *vide* Sound, Velocity of.

**Velocity of Water,** *vide* River.

**Vent**—A small channel in a piece of ordnance, through which the gun is fired by means of priming powder or a friction tube. The vent in S.B. guns is in a plane at right angles to the axis of the piece, but slightly inclined to the rear. In heavy M.L.R. guns, it is bored vertically.

A vent is formed by drilling a channel, $\frac{2}{9}$ inch in diameter, through a copper bush, which is screwed into the gun, the copper being specially hardened for rifled guns. There are two kinds of copper bushes used, viz. the *through vent*, and the *cone vent*. The through vent is a cylinder cut with a screw thread, and having a square head, by means of which the bush is screwed into the gun.

A cone vent is of the same shape and size as a through vent, except near the end where the screw thread terminates, and the cylinder merges into the frustrum of a cone.

When a gun is to be bushed for the first time, a cone vent is invariably used, because the copper will be denser and tighter at the bottom of the vent than would be the case with a bush screwed all the way down. The vent in heavy M.L.R. guns does not enter near the end of the bore as in S.B. guns, but strikes the cartridge at two-fifths of its length from the bottom of the bore, for it has been proved by experiments that by igniting the cartridge at this point the maximum initial velocity is obtained. In M.L.R. guns under the 64-pr. it strikes the curve at the bottom of the bore.

**Vent, Enlargement of,** *vide* Enlargement of the Vent.

**Ventaille** (French, *avant-taille*)—The name given by the Normans to all defences for the face afforded by helmets.

**Ventilation** (Latin *ventilatio*, from *ventus*, wind)—The act of ventilating. This is accomplished by means of ventilators which admit fresh air into buildings, and allow the escape of foul air. This subject is of such vast importance in barracks, hospitals, and magazines, that various means are used to secure the admission of a regulated quantity of fresh air into a closed or confined apartment, and the expulsion of vitiated air. It is well known that the atmosphere consists of three principal ingredients: nitrogen, oxygen, and carbonic anhydride. When these are maintained in their proper proportions, the atmosphere supports or sustains life, but when there is an excess of carbonic anhydride to the extent of 1 per cent., then it is incapable of sustaining life or combustion; respiration then becomes difficult, and death ensues.

It is further known that in the act of respiration a certain portion of the oxygen of the air inhaled is converted into carbonic anhydride, so that a person sitting in or occupying an apartment for any length of time to which fresh air is not admitted would deprive the room of its oxygen, and an excess of carbonic anhydride would ensue, to inhale which, as has been shown above, would bring death to the consumer. The object, therefore, of ventilation is to permit of a recurring stream of fresh air and the expulsion of foul air. There are various means of bringing this about, known to the engineer and builder. In barracks, the means adopted to introduce fresh air is to perforate the walls or place air bricks in them; and for the expulsion of the foul air, shafts are erected in the form of a chimney or funnel. Windows also act the part of ventilators.

In building barracks, a certain amount of air space is provided for every soldier, so that he shall have pure air to breathe in, and this is known to be so necessary for the health of the soldier thht the rule of air space must be adhered to in building his barrack. Hospitals require more air space than ordinary barracks, and in a tropical climate still larger space. Some estimates have been framed, as much as

20 cubic feet of air per minute for the soldier in England, and double this for the hospitals. In well built houses, and with few inhabitants in them, 3½ cubic feet of air per minute for each person will be sufficient.

Ventilators are very necessary in powder magazines (*q. v.*) to keep them dry.

**Vent-server** — An article used for serving the vents of M.L.R. guns, 64-prs. and upwards, in lieu of serving the vent with the thumb. It is made of brass, the part which enters the vent being encased with a thick conical piece of leather. A lanyard is attached to it.

**Verbal Orders**—Orders commonly sent on the field of battle by the general to any officer in command of a particular portion of the army with whom he wishes to communicate. Such orders are generally sent through an aide-de-camp, and must be considered equally binding with written ones.

**Verdict** — The opinion or decision arrived at by the members of a court-martial as to the guilt or otherwise of the prisoner. Known as the *finding* (*q. v.*).

**Vernier**—A graduated movable index invented by Pierre Vernier, a captain in the French army, who gave a description of it in a tract published at Brussels in 1631; it is used for measuring minutely the equidistant divisions of a graduated scale. As described by Mr. Heather, in his 'Treatise on Mathematical Instruments,' it is so constructed as to slide evenly along the graduated limb of an instrument, and permits of distances being measured or observations read off with remarkable nicety. In the vernier scale, described at page 11 of Mr. Heather's work, the divisions on the lower or subsidiary scale are longer than those on the upper or primary scale. In the vernier described below, the divisions are usually shorter than those upon the limb to which it is attached, the length of the graduated scale of the vernier being exactly equal to the length of a certain number $(n-1)$ of the divisions upon the limb, and the number $(n)$ of divisions upon the vernier being one more than the number upon the same length of the limb.

*Let, then,* L represent the length *of a division* upon the limb, and V, the length of a division upon the vernier:

so that $(n-1)\,L = n\,V$; and therefore

$$L - V = L - \frac{n-1}{n} L = \frac{1}{n} L;$$

or the defect of a division upon the vernier from a division upon the limb is equal to the $n$th part of a division upon the limb, $n$ being the number of divisions upon the vernier.

**Vertex**—The summit, height; in gunnery the culminating point of a shot's curve or trajectory.

**Vertical**—Upright; perpendicular to the surface of the earth or smooth water.

**Vertical Eprouvette,** *vide* Eprouvette, Vertical.

**Vertical Fire**—The fire from ordnance at high angles, for instance, from mortars, which being generally fired at an angle of 45°, the shells are observed to attain great height in their flight and to descend at considerable angles. Major (now Lieutenant-Colonel) Owen, in his lectures on artillery, remarks that "the fire of shells from mortars at high angles of elevation is most uncertain as regards accuracy; the reasons of this are that the shells, having comparatively low velocities, but long 'times of flight,' are peculiarly liable to considerable deviations from wind and other disturbing causes; also that the angles of descent of mortar shells, fired at the usual angle of 45°, are so great that, unless the object be of some extent, an error in range of a few yards over or under might render the shell useless, whereas, when a projectile is fired at a low angle of elevation, so much ground is covered by it, before and after grazing, that a few yards under or over would not probably prevent it striking the object. The very greatest care is required in weighing out the charges, for if this is performed carelessly, considerable differences will occur in the ranges. In vertical fire, as the object cannot be seen, and the piece is generally short, it is very difficult to lay the mortar exactly in the same line for a number of rounds, but if laying could be performed with the greatest accuracy, still irregularities would always occur in practice with projectiles fired at high angles and with low velocities."

The following general rules for mortar practice are herewith given:—"Although it will be found in practice that the charges of powder for similar ranges will constantly differ, owing to the varying strength of the powder, according to the state of the atmosphere, &c., the 13-inch mortar, with a charge of 3 lbs. of powder, gives a range of 850 yards, and every additional ½ lb. increases the range about 180 yards. The 10-inch mortar, with half the charge of the 13-inch, will give about the same range. The 8-inch mortar, with about one-third of the charge of the 13-inch, will also give about the same range. The elevation of the mortar for the above must be 45°; at 15°, the range is rather more than half that of 45°; at 10°, rather less than half, the charges being equal."

**Vertigo** — Mad staggers; a disease which horses occasionally suffer from.

**Veteran**—An old soldier; one who has been invalided, and is no longer fit for active duty. Veteran rank was formerly conferred on warrant officers in India, employed in the ordnance and commissariat departments, which gave them the position of an officer in the army with increased pay. Now, honorary rank is granted instead, which confers the position of an officer, but no pay; they remain, however, still in the employment of government, until invalided. James tells us that this word comes from the Latin *veteranus*, a soldier in the Roman militia who was grown old in the service, or who had made a certain number of campaigns, and on that account was entitled to certain benefits and privileges.

**Veterinary Art** (Latin, *veterinarius*, a cattle doctor; from *veterinus*, a beast of burden)—In Maunder's 'Treasury of Science,' the definition of this term is described as follows:—"A modern term for what was formerly called farriery. It comprehends a knowledge of the external form as well as the internal structure and economy of the horse; and embraces whatever relates to the diseases to which the horse is liable; with an accurate knowledge of the principles and practice of shoeing, of feeding, exercising, &c. that noble and highly useful animal."

**Veterinary Department**—One of the civil departments of the army. It is placed under the charge of a principal veterinary surgeon, who is responsible for the working of his department. It is composed of staff veterinary surgeons, veterinary surgeons of the 1st class, veterinary surgeons, and veterinary surgeons on probation. (*Vide* Appendix O.)

**Veterinary Surgeon**—An officer appointed to a regiment of cavalry and a brigade of artillery; he has the supervision of all the horses, and, in case of sickness, treats them medicinally. He has the rank of lieutenant on joining the service, and receives 10s. a day. With length of service, he gets increased pay and relative rank, and after 25 years can retire on half-pay.

**Vetterli Rifle** — A magazine rifle, adopted by the Italian and Swiss armies.

The barrel is of puddled steel, with a calibre of 0·41 inch. It has 4 grooves, with a pitch of rifling of 1 in 22. The cartridge is a bottle-necked rim-fire cartridge, of small capacity. Its length is 1·7 inch; its weight is 479 grains; that of the powder charge is 58·2 grains, and that of the bullet 341 grains. (*Vide* Appendix F.)

**Vibration**—The regular reciprocating motion of a body, as a pendulum, musical chord, &c. The effect of the accumulation of vibratory motion is displayed in the case of suspension bridges, some of which have been brought down by the steady marching of a body of troops, owing to the fact of the steps of the troops synchronising with the oscillations of the bridge. Troops in crossing such bridges, or bridges made of pontoons, or of any elastic material, should always be instructed to march out of step.

**Vice**—A tool for holding any article while the artificer is operating upon it, by placing it between two jaws or nippers, and screwing them towards each other.

**Vice, Hand**—A hand instrument which is described as being "used for filing small articles, a greater number of which are more conveniently filed whilst they are held with the left hand, the file being then managed exclusively with the right. This enables the artisan to judge more easily of the position of the file. In some cases a piece of wood called a filing block is fixed in the table or tail vice, and square, round, and similar pieces are rested in one of several notches made in the block with a triangular file. If the works are rectangular, or have flat surfaces, they are held quite at rest; if they are circular, they are continually rotated."

**Viceroy**—A title given to the chief officer of a dependency, who possesses delegated powers from the sovereign to represent the supreme authority, such as the lord-lieutenant of Ireland, and the governor-general of India. These are the only two appointments under the British crown bearing this title.

**Victoria Cross**—A reward "for valour." The order was instituted by her Majesty Queen Victoria in 1856, and is bestowed upon those members of the naval and military services, and to non-military men also, who perform conspicuous acts of gallantry on service in the field. It consists of a Maltese cross made of bronze, formed from the cannon captured at Sebastopol, with the royal crest in the centre, and underneath is inscribed, "For valour." It is worn with a red ribbon in the army, and blue in the navy. The order is open to all, whatever the rank, and however short the term of service of the individual may be. The decoration carries with it a pension of £10 a year.

**Victory**—The overthrow or defeat of an enemy; success in contest. In Brande and Cox's 'Dictionary,' it is stated that, in Roman mythology, Victory is described as a goddess, called Varro, the daughter of heaven and earth. Her altar was preserved in the Curia, or senate house, of Rome; and its destruction was the subject of one of the latest contests between Christians and pagans.

**Viewer**—An examiner of small-arms, or stores generally. At the government establishments at Enfield and Birmingham, there is a staff of viewers for the purpose of examining small-arms after they have been manufactured. In the Royal Gun Factory at Woolwich, there are also viewers whose duties are to examine every article during the different stages of the manufacture of a gun, to ascertain that the gun is manufactured *properly*, and to the correct dimensions. *All work* not strictly done in accordance with the working drawing is brought by the viewer to the notice of the superintendent.

**Vigilance** — Watchfulness, care, circumspection. A general in command of an army should possess all these qualities, and be ever on the *qui vive* to guard against surprise. Previous training, such as constant service in the field and through the different stages of his career, will conduce much to give an officer in command that vigilance necessary to be possessed by the leader of a force.

**Vinegar** (French, *vinaigre*, literally sour wine)—An impure form of acetic acid, obtained from wine, cider, beer, or other liquors, by acetous fermentation; also from wood, by destructive distillation. Vinegar is used in the composition of stars for signal rockets.

**Vis** (Latin)—Force.

**Vis inertiæ** (Latin = inert force)—The propensity of a body to remain in its actual condition, whether of motion or rest, and to resist change.

**Vis viva** (Latin = living force)—The *vis viva* of a body is its mass multiplied by the square of its velocity; "work" or dynamical effect supposes a body moved, and a resistance overcome; and either of these without the other is insufficient to constitute "work." The "work" produced by a pressure moving a body through a certain space is defined to be the product arising from multiplying the pressure by the space through which this pressure acts.

The following on the subject of "vis viva" is taken from the report of Captain W. Noble, R.A., on the penetration of armour plates:—"The 'vis viva' of a body in motion is the whole mechanical effect which it will produce in being brought to a state of rest, without regard to the time occupied, and it varies as the weight of the body multiplied by the square of its velocity. This mechanical effect or 'work' accumulated in the moving body is represented by the weight which it is capable of raising one foot high, and is equal to the weight of the moving body multiplied by the square of its velocity, and divided by twice the force of gravity or $\frac{Wv^2}{2g}$.

Thus, if a shot of 165 lbs. weight be moving with a velocity of 1470 feet per second, the 'work' accumulated in it will be represented by

$$\frac{165 \times 1470 \times 1470}{2 \times 32 \cdot 1908},$$

which is equal to 5,536,040 lbs. or 2472 tons.

"That is to say, the force stored up in this shot is capable of lifting a weight of 2472 tons one foot high."

**Visual Signalling**, *vide* Telegraphy.

**Volley**—The simultaneous discharge of a number of small-arms, corresponding with a *salvo* of artillery.

**Voltaic Battery**—The combination of a number of cells, each of which generates a certain quantity of dynamic or voltaic electricity. To M. Volta is due the first knowledge of the powers of voltaic currents, as shown by him in the *couronnes de tasses* and the voltaic pile. For mining purposes the battery devised by Professor Grove is the most suitable, in which the metals are zinc and platinum—the former in a solution of diluted sulphuric acid, and the latter in pure nitric acid, the liquids being separated by a porous earthenware cell. (*Vide* Galvanism.)

**Voltigeurs**—Formerly a French corps of light infantry, organised by the first Napoleon. They differed from *tirailleurs*, as they moved in a compact body. They were selected for their courage, activity, and small stature. Each regiment of the regular infantry of the army had a company of *voltigeurs* attached to it. On nearing the enemy, all the companies of *voltigeurs* united, and were the first in the fray. There is no such body of men now in the French army.

**Volunteers**—Men who voluntarily come forward to serve as a force for the defence of the country. In Great Britain, the volunteers consist of a large body of men, a great citizen army, which, with the militia and the reserves, form part of the auxiliary forces of the country. This force gives its services gratuitously, as the men receive no pay, as long as it is not embodied; but the arms are supplied by the government, and a small sum is voted annually by parliament to defray the necessary expenses of the clothing, &c. of the various corps and to provide for the pay of the staff.

The oldest volunteer corps is the *Honourable Artillery Company*. It was instituted in 1485; it ceased, however, to exist after a time, and was revived in 1610. In the civil war of 1641–8, the company took the side of the parliament, and greatly contributed towards its success. Although still called artillery, it comprises artillery (horse and field batteries) and cavalry.

The origin of the volunteers dates from 1793–4, when they were first enrolled in consequence of a threatened invasion from France. Between 1798 and 1804, this force numbered 410,000, of which 70,000 were Irish. After this date, as the immediate danger ceased, the force gradually diminished. The volunteer force as now established arose in 1858, though a few corps were raised previously. In 1859, 150,000 men organised themselves into volunteer corps of riflemen. In the following year, the government gave this national movement assistance by appointing paid adjutants and drill instructors, and by the establishment of a staff of inspectors, under the control of an inspector-general of volunteers (now of auxiliary forces).

The regulations appertaining to this force are contained in the Volunteer Acts of 1863, subsequently modified in 1868 and 1869, and in the Regulation of Forces Act of 1871. Volunteers are localised by corps, so many being attached to each brigade forming the subdistricts of the army. According to the regulations, when sixty men can be got together, a company may be formed, which is entitled to a captain and two subaltern officers. If six companies can be raised, they constitute a battalion for which government provides an adjutant. This officer, if not commissioned as captain in the regular army, is granted the temporary rank of captain. When there are a number of detached companies in a district, they are grouped into an administrative battalion.

Adjutants and sergeant instructors are at all times subject to the Mutiny Act; the other officers and the men of the volunteer forces are only subject to it when their corps is embodied. All officers are appointed by the crown, except sub-lieutenants, who receive their commissions from lords-lieutenant of counties; non-commissioned officers are appointed by the officer commanding. Every volunteer on joining must take the oath of allegiance, and must be of the age of seventeen. A War Office circular lately issued directs that no person under 5 feet 6 inches in height, or less than 32 inches round the chest, can be enrolled in an artillery volunteer corps, and no person under 5 feet 3 inches in height, or less than 32 inches round the chest, can be enrolled in other volunteer corps.

Volunteers are not enrolled for a fixed time, but can leave on giving fourteen days' notice. They are classed as "efficients" and "non-efficients." Efficients must have received certificates from the commanding officer and adjutant, certifying that they have acquired a knowledge of their duties and attended certain drills. Efficients receive then a sum of money termed "capitation grant," viz. 30s. as a recruit and 9s. annually afterwards. A special grant of £2 10s. is also allowed to every officer and volunteer sergeant who holds a certificate of proficiency, for which an examination has to be passed. A travelling allowance is granted for attendance to united drills or gun practice.

The volunteer force cannot be employed to put down civil disturbances, but it may be called out by parliament with the sanction of the crown to serve anywhere in Great Britain whenever the country is invaded, or when an invasion is apprehended. The volunteers would then be mobilised with the regular army and the militia, according to the scheme laid down in 1876. (*Vide* Mobilisation).

The volunteer force is divided into light horse, artillery, engineers, mounted rifles, and rifle corps (infantry), ranking among themselves in the order given.

There are 5 troops of *light horse*, furnishing an effective of 365 officers and men; 214 corps of *artillery*, divided into brigades, with a total strength of 31,823 efficient men. Every year, an assembly of artillery volunteers for gun practice, lasting about a week, is held at Shoeburyness.

The *engineers* form an effective force of 6295 men, divided into 21 corps. The *mounted riflemen*, of which there are 4 corps, give a total effective of 139 men; they are attached to the administrative battalions of the *rifle volunteers* of their district. These are divided into 118 administrative battalions and 97 detached corps. (*Vide* Appendix E.)

There is besides an *engineer and railway transport volunteer staff corps*, composed of engineers, contractors, &c. and formed for the working of railways in time of war. (*Vide* Railways.)

The infantry is armed with the Snider-Enfield rifle and the artillery with the Snider converted carbine.

In order to promote the practice of rifle shooting among volunteers, a National Volunteer Association was established in 1859 under the patronage of the Queen and the Prince Consort, nearly every county possessing rifle corps responding to the appeal and forming a rifle association. Its first meeting was held at Wimbledon in 1860. In a few years, this association increased in importance, and the number of prizes distributed at the Wimbledon meeting rose from 67, in 1860, to 1694 in 1874, whilst their total value increased from £2500 to £12,987. The number of these associations, attached to the national one, is 69 in England and Scotland, 2 in Ireland, and 31 in the colonies. The total number of subscribers was 3089 in 1874.

Any person subscribing a guinea a year, or compounding for life by paying ten guineas, can become a member of the association. The rifle associations of the different counties organise each year rifle matches, after which a few of their members are appointed to take part, under certain conditions, in the general contest of the national association. This contest takes place every year on the plain of Wimbledon, situated 9 miles from London. A camp is established there, where detachments of volunteers spend about a fortnight under canvas.

Volunteer regiments are also formed in India and the colonies. (*Vide* Army List.)

The name *volunteer* is given to officers and soldiers who, when called upon for any specific duty, voluntarily step forth.

**Voucher**—A written document or proof upon which any account of public charge is established.

**Vulcanite**—A compound consisting of two parts of caoutchouc and one part sulphur, boiled together at a temperature of 200° Fahr. It is used in the manufacture of water-hoses, combs, &c., and being a good insulator, is considered the best material for the covering of telegraph wires.

## W.

**Wad**—In artillery, is described as a solid cylinder of tow, or a circular ring of rope, old rope-yarn, or other material. Wads are used in the service of guns, smooth-bore and rifled, chiefly for the purpose of keeping the shot in its place, but also for other reasons, as shown below. There are six natures of wads, viz. *junk*, *grummet*, *papier-mâché*, *coal-dust*, *wedge*, and *Bolton's* wads. *Junk* wads are made of oakum beaten into a solid cylinder, and woolded over; they are of similar diameter to the bore of the gun for which they are intended. They were used in firing hot shot, and are now used in connection with the tampeon to close the muzzle of a gun. *Grummet* wads consist of a piece of rope formed like a ring, the external diameter being equal to the calibre of the gun. They are used when firing at angles of depression, or at angles of elevation less than 3°, to place over the shot, and so prevent it from moving out of the piece. *Papier-mâché* wads are used for closing the fuze holes of filled common shells, and the loading holes of diaphragm shells. *Coal-dust* wads are made of serge, in the form of a bag, and filled with coal dust; they are placed inside the 5-lb. cartridges of 8-inch guns to fill up the chamber.

For rifled M.L. guns of the heavier natures a wad consisting of two wooden wedges connected by a piece of cane is used. The object of using this wedge wad is to keep the projectile in its place, as it is apt to move forward when the gun is depressed.

*Bolton's* wads are made of 75 per cent. of old rags and 25 per cent. of tarred rope, pulped and formed in a mould, and coated with waterproof varnish; they are used to prevent scoring of the bore.

The wads are rammed home separately after the projectile.

Gun wads are stated to have no effect upon the velocity of the ball, neither do they serve to lessen the windage, as the inflamed powder is found to escape past them. It is further found from experiments that the grummet wad is more efficient than one of junk, both in preventing the cartridge from shifting its place in the bore of chambered ordnance, and in lessening the deviations of projectiles.

**Wadhook** — An instrument which forms part of the stores attached to a battery, and used for searching the bores of guns and withdrawing from them anything that would impede the loading.

**Wadmiltilts**—Strong rough woollen cloths, used principally for covering powder barrels and protecting ammunition generally. A barrel of powder wrapped in a wadmiltilt is safe from the explosion of two similar barrels in the open, at a distance of 10 feet, but it is unsafe when not so wrapped at a distance of 15 feet.

**Wager of Battle**—An ancient mode of settling disputes by single combat. It took place in cases, whether civil or military, the defendant challenging and fighting the plaintiff, if so inclined, in order to prove the justice of his cause.

It was also a custom in affairs of chivalry and honour.

**Wagon**—A carriage on four-wheels, drawn by horses, and used for the transport of heavy goods. The following are the principal wagons found in the service, the uses of which are briefly described as follows:—

*Ambulance wagon* (*q. v.*).—Used for the carriage of the sick and wounded.

*Ammunition wagon.*—In the artillery service, a carriage with limber attached, which accompanies each gun of a movable battery. It contains the larger proportion of the ammunition of the battery. Light field batteries have one wagon to each gun on the peace establishment, and two on the war establishment, which enables a battery to go into action with a good supply of ammunition per gun.

*Baking wagon.*—A wagon in which the bread of the troops is kneaded along the line of march; it carries the necessary dough troughs and baking implements.

*Boat wagon.*—Attached to the pontoon trains, for the transport of one boat and a certain portion of bridging material.

*Bread and meat wagon.*—A wagon for holding and carrying in the field all such supplies as give the name to this nature of carriage.

*Forge wagon.*—Composed of a limber and carriage; the limber is the universal limber, but has one long box instead of two. The body of the wagon contains the bellows and all the other articles necessary to complete the forge. One is attached to each battery of artillery; two to each mounted troop of engineers, and one per cavalry regiment.

*General service wagon.*—For general use with a siege train; there are 4 wagons of this nature, 2 without and 2 with springs. What is known as the G.S.W. mark I. without springs has equirotal wheels, fore and hind. It carries a spare wheel, and has fittings to transport intrenching tools; also, when required, it is able to take a field forge. It has a long body covered with waterproof canvas; it is capable of carrying 1½ ton, and is fitted for shaft or pole draught.

*Miner's wagon.*—Attached to the engineer branch, to carry mining and intrenching tools.

*Office wagon.*—Belongs to the engineer branch, and is used as a telegraph office. It may be used also as an office wagon, printing wagon, lithographic wagon, or photographic wagon.

*Platform wagon* (*q. v.*).—A wagon used for every description of heavy stores, &c.

*Pontoon wagon.*—Carries a pontoon and a portion of the bridging material on the march. (*Vide* Pontoon Train.)

*R.A. wagon.*—Fitted to carry a spare wheel, intrenching tools, carbines, two swords, stores, and a drag shoe with chain; it has certain fittings to enable it to be used as a forge wagon. One wagon is attached to each battery, and it is fitted for either single or double draught.

*Rocket wagon.*—Intended to carry Hale's rockets; it only differs from the ordinary field ammunition wagon, in the boxes being made deep enough to receive 25 rockets each.

*Siege wagon* (*q. v.*).—A general service wagon. It is fitted with movable trays, for the transport of shot and shell.

*Heavy sling wagon.*—This wagon is used in the artillery service for transporting guns from 12 to 23 tons in weight. It is similar in construction to the service wagon, but is made of African oak scantling of much larger dimensions, and is fitted with breaks similar to those on the 12-ton sling wagon, but worked by levers and eccentrics; the perch is fitted with a differential block and chain; and the axletree arms are special for the wheels. The 12-ton sling wagon is made of wrought iron.

*Store wagon.*—Similar to the miner's wagon. It has a movable head covered with canvas. It is issued for carrying stores of all sorts, intrenching tools, &c. of a siege train.

*Trestle wagon.*—The same as the pontoon wagon; it carries part of the superstructure of the bridge without a pontoon.

*Water wagon.*—Used to carry water for troops on the march, or in quarters. It contains a barrel for holding the water. It is fitted for single, double, or pole draught.

*Wire wagon.*—A wagon attached to engineer troops. It contains the wire and all other articles for setting up a telegraph line along the line of march.

**Wahrendorff Gun**—A two-grooved breech-loading cannon invented in 1846 by Baron Wahrendoff, a Swedish nobleman. The mechanical contrivance for securing the breech is very superior to the rude process of earlier times, but it appears doubtful whether the mode of closing it is strong enough to ensure safety when high charges are used. Experiments made with this gun at Shoeburyness showed that it was capable of long range, but the deflection was so great and variable that no allowance could be made for it in laying the gun with respect to the object.

**Wailing**—A mode of basket work, pursued in forming a gabion, and in which the braid or plait is formed with more rods than two. (*Vide* Brushwood.)

**Wallet**—A kind of bag, introduced into the service in lieu of the holster. Wallets form part of the horse furniture of the staff and regimental staff of the army. All cavalry regiments, except the household cavalry, use them. They are made of brown leather, and covered, like holsters, with a bear skin.

Wallets have also been introduced into the Indian army.

**Wall-knot**—A knot made at the end of the lever and prypole rope, to prevent it from being drawn through the hole in the lever.

**Wall-piece**—An enlarged firelock or fire-arm mounted on a swivel, and placed on the walls of a fort or other fortified work. It may be said to be obsolete, though sometimes issued in India to an expedition proceeding on service. Wall-pieces are considered to be useful, after the capture of a native fort, to strengthen its defence. At the late siege of Strassburg, the Germans made considerable use of this nature of arm.

**Wall-plate**—A piece of timber placed on a wall, on which girders, joists, and other timbers rest.

**Walls, Defence of**—The means adopted for rendering walls protective, whereby the defenders can shelter or screen themselves from the fire of the enemy.

The chief method of putting walls into a state of defence is by means of loopholes formed according to circumstances, depending on the heights of the walls. In works on the construction of military posts, it is suggested that loopholes should be formed on the tops of walls which may be about 4 feet high, with sandbags, blocks of wood, stones, or other materials at hand. If the walls be too high to fire over, small banquettes should be made, or the loopholes may be cut down into the top part of the wall. In any case, small ditches should be dug on the enemy's side of the wall.

Besides the ditch outside, when walls are 7 or 8 feet high, one in the rear should be dug to give sufficient cover to the defenders, and to prevent the enemy from firing over.

With lofty walls, two tiers of fire may be obtained by forming banquettes, so as to enable the defenders to fire over the wall or through loopholes at the top, and by cutting loopholes for the lower tier nearly on a level with the ground. Trenches must be dug in rear of the walls to allow of the defenders using the lower loopholes; but on no account must there, in this case, be ditches excavated in front of the walls, unless they be made deep enough to prevent an enemy standing in them from firing through the loopholes.

With low walls the ditches must be formed close up, and the earth spread. Loopholes should always be at least 6½ feet above the ground or bottom of the ditch on which the attackers can stand.

The proper defence of walls will generally suggest itself to most officers; the foregoing merely gives an outline of what ought to be done.

**Walnut** (*Juglans regia*)—A tree indigenous to Persia. It has long been introduced into Great Britain; it is a dark-coloured and close-grained wood. It is largely used for the stocks of small-arms. The walnut grows also in the Himalayas and in the upper provinces of Burmah.

**War** (Anglo-Saxon, *wær*)—A contest carried on between the armed forces of two states or nations, after every endeavour has been resorted to, by one side or the other, and often by friendly powers, to bring about a reconciliation.

Wars are either *international* or *civil; aggressive* or *defensive*. An international war is that between two states or nations which acknowledge, by the law of nations, certain rights that exist towards each other; when a third power joins as an ally, it becomes a *war of intervention*, or *auxiliary war*. A civil war is carried on between parties of the same state; it is either *legal* or *illegal*, *political* or *religious*. An aggressive war takes place when a nation, on some imaginary or real wrong, considering its honour to have been attacked by a neighbouring nation, begins hostilities against that nation when at peace with it; defensive war is the opposite to that of aggressive, being the attitude taken up by a nation to repel an invasion or the attacks of an enemy. Wars differ according to circumstances and objects; international wars occur generally in consequence of disputes about territorial possessions, material interest, acquisition of territory (*wars of conquest*), or for supremacy of power; civil wars on account of some important point of civil or religious liberty. But in all cases the object is the same: to weaken and overthrow the opposing party, and to force it to submit to the terms of the stronger.

Before hostilities begin, a declaration of war is made by the aggressive party, which is perfectly free to choose the form in which it will announce its intentions. Formerly it was proclaimed by a herald being sent to the enemy, who in a formal manner declared war, but this mode has been abandoned, and in modern times a manifesto is published by the aggressive nation to the neutral and friendly powers, declaring the reason why peace is broken, and generally stating that, though it desires to remain on friendly terms, it is forced to fight against its will.

Permission of *reprisals* (*q. v.*) follows the issue of the manifesto, and is usually the last step short of actual hostilities and preceding them.

Strategically speaking, a war is either *offensive* or *defensive*, depending on circumstances. Colonel Hamley, in his 'Operations of War,' shows that, before the commencement of hostilities, a belligerent government which knows its own resources, and should know those of its enemy, must decide whether its army shall make or await the attack. Though circumstances may occur to cause both armies to advance simultaneously to the region or frontier which separates them, into the territory occupied by the adversary, it is more usual for one army to stand on the defensive whilst the other commences the attack. *Offensive warfare*, therefore, means the advance of an enemy into an enemy's territory, and *defensive warfare* the defiant attitude of a country about to be invaded.

In assuming the initiative, the *objective*, that is the object to be gained by the campaign, is to be decided upon by the invading general. The end generally aimed at is to occupy the enemy's capital, as it paralyses the trade of the country, and forces the sovereign and government to retire to a place of safety, and often leads the enemy to come to terms, thus saving himself from complete ruin. The objective having been decided upon, the *theatre of war* must be selected.

The considerations which induce a power to choose a certain portion of the country in which it intends to operate may be political or geographical, or dependent on the relative strength of the belligerents, or the comparative facilities for mobilisation and concentration afforded by their respective systems of organisation. The advantage generally remains with the army possessing what is called the *initiative*, that is, the power one army has of compelling its adversary to make his movements dependent on its own; the chances are then in favour of the assailant, provided the campaign is carried on in a country suitable for military operations, and advantage taken of the power the assailant has of concentrating his forces.

The advantage to be gained in standing on the defensive is the vast area an army has of extending itself; it can thus be more easily supplied; as stores can be collected at any central point, instead of upon one particular focus. The roads and railways placed in the rear, being in the possession of the defender, enable him to bring up his food, ammunition, &c. with comparative ease; and in case of his having to fall back, the measure is greatly facilitated, and the requirement of transport less pressing, as, on retiring, he approaches nearer to his magazines and his sources of supplies. But these advantages are greatly counterbalanced by those possessed by the advancing army, which can concentrate behind its frontier, and descend on any point of the defender's line, the defender's movements being thus, from that moment, dependent on those of the attacking force. The defenders must either oppose the enemy with small numbers at first or lose territory in order to fall back and concentrate. On the other hand, offensive war demands great resources, as the more the invader advances into the enemy's country, the longer and more exposed to attack become his lines of communication. Under these circumstances, it must not, nevertheless, be forgotten that an army acting on the defensive is not to be supposed as always confining itself to this attitude. To act thus, would be fatal to the ultimate object it had in view. When an opportunity is offered, every endeavour should be made to take the offensive, by placing itself in such a position as to threaten the enemy's rear, cut him off from his base, and so obstruct his communications that his magazines will be in danger. To prevent this, the invading force will have to weaken its main army by being forced to detach a considerable part of it to protect its communications with the rear, and the defensive force may then, if strong enough, harass the enemy, and turn its position of defensive into one of advantage.

War, notwithstanding its sad and disastrous effects, is an event that a nation must always be prepared to face, or else allow itself to be wiped out of the roll of nations. History admonishes us that, as in the past, mankind has ever been prone to arms, so in the future must war be expected, however peacefully disposed the interests of nations may be. It behoves rulers therefore to be prepared to avenge insult, and to repel encroachment, and by an attitude of strength and determination to avert, if possible, the dread necessity of recourse to arms, on the principle of "Si vis pacem, para bellum."

This preparedness is carried out by nations in keeping up large armies ready to be mobilised within a few days' notice. To be always in this state of preparation necessitates in time of peace a constant watchfulness in the drill of the soldier, in the use of his arms, and in that practical knowledge of the science of war so necessary when the day of trial comes.

It cannot therefore be too often impressed on the officers of our army that, if they wish to be pre-eminent in their profession, the study of war must be the occupation of their lives. The perusal of the works of military writers, past and present, will afford such information as will enable them to become proficient in much that is required to render them capable of command in the day of battle.

The study of the war of 1870–71 on the continent affords many lessons, and much information, as to how armies may be destroyed, and opportunities lost, by bad generalship, and, on the other hand, how success may be ensured when troops are properly handled.

The subject under consideration is one of such magnitude that it is not possible within the limits of this work to enter into a description of the various phases of war; but those interested in the subject are referred to Colonel Macdougall's 'Theory of War,' Colonel Hamley's 'Operations of War,' as well as to the late Colonel Chesney's articles in the *Edinburgh Review*, published in 1866, which works, with many others, will give a close insight into the science of war, the management of an army, and the qualifications required of the general in command to bring a campaign to a successful issue.

**War, Council of,** *vide* Council of War.

**War Office**—The head-quarters of the Secretary of State for War, to which are attached the offices of the three great officers of the army, viz. the commander-in-chief, surveyor-general of ordnance, and the financial secretary. These offices are respectively organised for—

1. Supervision, recruiting, training, discipline, distribution, and command of the army;
2. Supply of all kinds, transport, and quarters;
3. Pay and audit.

This distribution is carried out in all subordinate commands:

Staff;
Control office;
Paymaster.

*Minor departments.*—Control department of War Office, record register, stationery, solicitor, and library.

*Works division.*—Inspector-general of fortifications, barracks, forts.

*Medical division.*—Director-general.

**War, Prisoners of,** *vide* Prisoners of War.

**War, Science of,** *vide* Science of War.

**War-cries**—Cries of mutual recognition and encouragement formerly used in battle, each nation, tribe, or clan, having its own.

"The war-cry, *cri de guerre* of the French, the slogan or ensenzie of the Scotch," writes Mrs. Bury Palliser, in her book on 'Historic Devices, Badges, and War-cries,' "is of the remotest antiquity. 'The sword of the Lord and of Gideon'—the battle-cry of the Israelites when engaging the hosts of Midian in the valley of Jezreel—is perhaps the earliest record of the use of the war-cry.

"Each nation usually invoked its patron saint; but in war, each party had its separate cry. The 'droit de bannière' and the 'cry de guerre' were conjointly the attributes of nobility. Of Sir Simon de Felbridge, for instance, it is said, he was a gentleman 'de nom, d'armes et de cry.'

"'Percy! Percy!' was the rallying-cry of Otterbourne; and the cry of 'A Warwick! a Warwick!' decided the fate of Banbury Field.

"So widely did the practice prevail in England that, in 1495, an act of parliament was passed forbidding all these cries as productive of discord, and enjoining all noblemen and their retainers thenceforth to call on 'St. George and the King.'"

The ancient war-cry of the kings of England was, "Montjoie, Notre Dame, and St. George!" that of the French was, "Montjoye, Saint-Denis!" and that of the Spaniards, "San Iago!"

In the feuds of the middle ages, each party had a distinctive war- or rallying-cry, generally the name of the family or clan; thus, in Scotland, the retainers of the houses of Douglas and Home rushed into the battle with the cry of "A Douglas! a Douglas!" or "A Home! a Home!" "Esperance, Percy!" was that of Hotspur at the battle of Shrewsbury, and "Set-on!" and "Abo!" of Seton, Earl of Morton. The cries of "Crom-a-boo!" and "Butler-a-boo!" were from an early period the cries of the Irish, and were especially prohibited. "Laundaig Abo!" "The Bloody Hand!" "Strike for O'Neil!" were the battle-cries of the wild followers of Shan O'Neil. It is stated that "Dieu et mon droit!" was probably a war-cry long before it was adopted as a royal motto, for Richard I. is recorded to have said, "Not me; but God and our right have vanquished France at Gisors."

"The Puritans," writes the author quoted above, "brought in Scripture words; and the war-cry of the tribes who revolted against the house of David, "To your tents, O Israel!" was adopted by the republicans of the seventeenth century. At the battle of Hylton-on-the-Wear, in 1644, the field-word of the Scots was, "The Lord of Hosts is with us!" that of the Marquis of Northampton, "Now or never!"

Although war-cries have come into general disuse in modern times among the armies of civilised nations, they have been revived, in certain circumstances, as an encouragement in battle. The "Shoulder to shoulder, Highlanders!" is well known in the Highland regiments; the soldiers of Napoleon were accustomed to charge with shouts of "Vive l'Empereur!" or later, "Vive la France!" "Vaterland! Vaterland!" and "Hurrah!" could be heard as a rallying-cry of the Germans on many a battle-field during the last wars. And in the British army the war-cry of the soldier is "Hurrah!"

**Warrant**—In a military sense, a writ of authority inferior to a commission; also a document under the sign manual authorising the assembly of a general court-martial.

**Warrant Officers**—Officers who are not commissioned, exercising their authority by warrant only. There are several departmental grades of warrant officers in the Indian army. (*Vide* Conductors.)

**Wash Leather,** *vide* Chamois Leather.

**Washer, Drag**—A flat iron ring on the axle-arm of carriages, having an iron loop attached to it for the purpose of fastening the drag rope when necessary; hence the term *drag-washer*. It is placed on the axle-arm to prevent the wheel or nave from pressing upon the linch-pin.

**Waste Weir**—A construction made to carry off the waste water of a stream which has to be dammed up. Such an arrangement is necessary, for if the water were suffered to accumulate and flow freely over the surface of an earthen dam, it would soon wash it away. A channel for a waste weir should be cut through the solid ground, clear of the dam, when possible; if not, it must be formed in the dam itself.

**Watch**—A duty performed by troops on board ship. All the non-commissioned officers and men, exclusive of those detailed for guard duties, are divided, at the discretion of the commanding officer, into three watches, one of which, the Queen's Regulations state, is to be constantly on deck, with at least one subaltern officer in charge, when practicable. In fine weather, every man not employed on duty below is to be on deck during the day. The watches go on duty for 12 hours, and are relieved at 8 A.M. and 8 P.M.

**Water** (symb. HO; equiv. 9; spec. grav. 1)—An element which, when in a state of purity, is a clear, colourless, transparent liquid, perfectly neutral in its reaction, and devoid of taste or smell. When exhibited in its aëriform state, water contains two parts of hydrogen and one of oxygen gas, and when united chemically and reduced to a fluid state, it constitutes what is known as water.

Water is obtained from two sources: rivers, and wells or springs; it is scarcely ever found pure, every kind being more or less impregnated either with saline, earthy, or mineral substances. River water is the safest to drink; spring water, which has often to be drawn from some depth, may contain earthy substances according to the soil it has passed through; it may be hard or soft, sweet or brackish, clear or turbid. The water of some rivers, at certain times, is thick or muddy; shallow well water is seldom in a pure state, and such water should always be rejected, unless it has been purified by artificial means, as it may contain some soluble substance deleterious to the system. Marsh water is most injurious.

The health of the soldiers and that of the cattle belonging to an army is to a great extent dependent on the purity of this element, as there can be no doubt of the injurious effect upon the health produced by drinking impure water. It produces dysentery and diarrhœa, and it is considered to be one of the chief causes of those fearful diseases which have devastated armies in many wars.

The greatest attention should be paid, therefore, to the supply of water before selecting positions for encampments, either permanent or temporary; wells have to be avoided as much as possible, and river water to be first sought for. If troops are in cantonments, drinking water should be filtered, and, if not pure, it should be boiled and then placed in shallow vessels and poured from a height from one into another. In India great attention is paid to this subject, as impure water is known to bring on cholera and to predispose the body to this disease when it is prevalent.

Sir G. Wolseley, in his 'Soldier's Pocket-book,' gives the following as the quantity of water required per man for drinking and cooking purposes:—"It may be put down at 6 pints in temperate and 8 pints in tropical climates. A similar amount will just allow men to wash their bodies. In stationary camps, however, the minimum daily allowance per man should be 5 gallons for all purposes, washing clothes included. Horses not doing work will thrive well on 6 gallons a day, but require from 8 to 12 when at work, according to their condition and the nature of the work. A couple of gallons extra should, under all circumstances, be allowed for washing them. Oxen require about 6 or 7 gallons daily."

**Water Barrels**—Barrels used for the conveyance of water in camps or cantonments where carts are not at hand. They are slung by means of two poles about 5 feet long.

**Water Engine**, *vide* Fire-engine.

**Water Shell**—A common shell filled with water, having a gun-metal cylinder screwed into it, containing ½ oz. of gun-cotton. This nature of shell, which receives its name from being filled with water instead of gunpowder, is the invention of Mr. Abel, F.R.S. The experiments carried on with this shell by the committee on explosives, a few years ago, proved it to be a valuable invention; and this has been further confirmed in the artillery practice at Okehampton (in August 1875). The shells so filled and fired, as compared with gunpowder, show a preponderance of destructiveness, the water shell bursting, as was shown, into 300 fragments; whereas the same shell filled with gunpowder only split into 30 pieces. The mode of bursting this shell is by means of a detonator consisting of *dry* gun-cotton (*wet*, it appears, will answer as well), enveloping a small cap of fulminate of mercury inserted in the apex of the fuze hole, in addition to the ordinary fuze. The theory of the employment of water as the disruptive agent of shells is explained in a recent number of the *Times* as being "based upon its power of transmitting the force developed by a sudden explosion of detonation, thus bringing it into operation at the same instant upon every part of the walls of the shell." Mr. Abel, in his paper on "The Recent History of Explosive Agents," states that, in the course of the trials made by him on the subject of bursting shells with water, "the detonative effect produced by small detonating charges when exploded in shells which were filled up with water and entirely closed was proportionate, not simply to the amount of explosive agent used, but also to the suddenness of the concussion imparted to the water by the explosion. Thus, 0·25 oz. of compressed gun-cotton, detonated in a shell filled with water, broke it up into nearly eight times the number of fragments obtained by exploding a shell of the same kind full of gunpowder (viz. containing 13 oz.). When picric powder, which is also a very violent explosive agent, though much less sudden in its action, was detonated in one of these shells in the same way as the small charge of gun-cotton, 1 oz. (or an amount four times greater than that employed by the latter substance) burst the shell into about the same number of fragments as were produced by the 13 oz. of gunpowder (instead of about eight times the number), produced by means of 0·25 oz. of gun-cotton." But even more striking results have been obtained on this point. "Thus, a 16-pr. shell, filled with about 16 oz. of gunpowder, was broken by the explosion of the charge into 29 fragments. The detonation of ¼ oz. of gun-cotton confined in a shell of precisely the same construction and weight, the chamber being filled up with water, burst the shell into 121 fragments, which were violently dispersed. A corresponding charge of gun-cotton, confined in a third similar shell, filled up with water, broke it into 300 fragments, and in addition there were *2 lbs. 1 oz. of* the shell, almost pulverised *by the force* of the explosion, brought to bear upon the metal through the agency of the confined water. These results are quite conclusive as to the manner in which the action of the water shell is brought about, and show that only such a brisk explosive as gun-cotton, or disruptive agents of similar character, would be useful as a bursting charge for the water shell."

**Water Troughs**—Pieces of wood or stone hollowed out longitudinally on the upper side for cattle to drink from.

**Water, Velocity of,** *vide* River.

**Water-deck**—A water-proof covering for the valise, either made of india-rubber or fine oil-cloth.

**Watering-place**—Any place selected in a camp from which the supply of water is obtained either for drinking, cooking, washing, or bathing purposes.

Great care should be exercised, when the supply is obtained from running streams, that the water for the washing supply does not run into the water for drinking. The points where water for drinking and cooking is drawn from, and those where horses and cattle are taken to be watered, should be well marked out, the latter being below the former, and again below this the place where washing and bathing is carried on. When there is scarcity of water, sentries are posted over the wells or streams from which it is drawn.

**Waterproof Paper**—Paper that has been impregnated with a solution of bees-wax dissolved in rectified coal-tar naphtha, in the proportion of 2 lbs. of wax to 1 gallon of the solvent. This has been proposed by Mr. Abel, F.R.S.

The waterproof bags for Snider-Enfield rifle ammunition are formed of two sheets of paper made perfectly waterproof by an even intermediate layer of india-rubber. This paper is cut to the size required, and the ends and sides joined by coating the overlaps of ⅜ inch with india-rubber cement, which, when dry, are pressed together with an elastic roller.

The india-rubber solution is composed of—

| | | |
|---|---|---|
| Naphtha .. | .. | 98½ lbs. |
| India-rubber | .. | 21½ „ |

and the cost of making 1000 of these bags is estimated at £1 0s. 2½d.

**Waterproofing Composition** — That known as Abel's composition is used for rendering canvas waterproof. When ready for use, it is laid on the canvas with a hard brush and then worked in with a hot iron.

**Wave Action**—In gunnery, is a name applied to the abnormally high pressures which are found to occur in a gun when very large charges are used; they appear to be local, and do not give increased velocity to the shot.

**Waver, To**—To hesitate before the enemy under a withering fire; to be undecided whether to go on or retreat. This feeling may be brought about from panic seizing the troops, or from loose formation, causing the order of the march to be desultory. It occurs, sometimes, from the officer in command hesitating as to his future movements.

**Wax**—An organic product of considerable importance; it is obtained from different sources, the chief of which is the bee-hive, where it is used by the bees in the formation of their cells. The characteristic properties of good wax are its roughness when chewed, its non-adherence to the teeth, and its fragrant honey-like smell. The substances generally used to adulterate wax are, resin, tallow, and earth. The latter may be detected by melting the wax, when the earth will subside to the bottom as it cools, and may be removed with a knife. Tallow may be inferred when the wax breaks smooth, and adheres to the teeth when chewed, also by the absence of the honey-like smell. Resin may be detected by putting small pieces of wax in spirits of wine; the resin will be dissolved, leaving the wax uninjured.

When the wax has served its purpose in the domestic economy of the hive, it is collected for manufacturing purposes, and goes through a certain refining process before it is taken to the market. Bees-wax is now largely used as an ingredient in lubricating cartridges, and undergoes the following examination before it is employed for this purpose:—

" *Examination of Bees-wax for Cartridges.*

"Press a small fragment of wax repeatedly between the first finger and thumb, so as to spread it down the latter. The wax should curl away from the thumb as the finger descends. If it clings tightly to the thumb, and becomes very soft and smeary, the adulteration with some description of fat is indicated. This test, though very crude, is sufficiently good to serve for the detection of any considerable adulteration of this kind. A piece of *blue litmus paper* pressed upon a piece of the wax (with a knife or rod, but not with the finger), which is thus heated gently on a metal service, until it begins to melt at the edges, should exhibit no change of colour to red. Several fragments of wax are placed in a wide test tube and gradually heated (the tube being moved in and out of the flame) until perfectly melted. The wax in this state should be quite clear and transparent, and free from mechanical impurities. The heat should be applied to the wax until the portion of the tube containing it can no longer be touched by the finger (the temperature being about 220° Fahr.). If it has then exhibited no signs of frothing, it is free from water. If much of the latter be present, the wax will begin to froth even before it is completely melted, and as the heat is raised, a crackling noise will be noticed. Water may be expelled from wax by maintaining the latter at a temperature of from 200° to 220° Fahr. until frothing ceases."

**Weapon**—Any instrument of offence or defence. (*Vide* Offensive Weapons.)

**Web**—A material used in a saddle. It is made of coarse canvas 9 inches × 3 inches, nailed across the two side bars. Its use is to prevent the seat of the saddle from being pushed up by the peg on which it hangs.

Web made of pure hemp is used for girths, man harness, and for cartridge cartouches.

**Wedge**—In mechanics, one of the six mechanical powers. It is commonly used for separating bodies which are strongly bound or pressed together, such as for cleaving timber, in which case it is urged by percussion. It is also used sometimes for raising heavy bodies.

**Wedge Gun**—A gun in general construction similar to the B.L.R. guns of the service, and rifled on the same principle, so as to fire a lead-coated shot, but the method of closing the breech is [illegible] different from that of the screw and vent-piece gun. It is thus explained in Lieutenant-Colonel Owen's 'Modern Artillery': —"In the wedge and stopper gun a slot passes through the breech from side to side, and the parts which close the bore are therefore inserted or withdrawn at the side of the piece, instead of at the top; by this arrangement the gun may be loaded more rapidly, and with much less labour, and the detachment is less exposed than with the screw and vent-piece gun."

The wedge guns of Sir W. Armstrong's manufacture (40-pr. and 64-pr.) were introduced into the service in consequence of the objection urged against his breech-screw guns.

**Weights and Measures,** *vide* Appendix M.

**Weights of Animals**—An elephant (including his load of 13 cwt.) weighs 72 cwt.; of which four-tenths is borne on the hind legs.

The weight of an elephant in draft may be taken as 66 cwt.

A camel: average weight, 15 cwt.; this includes the load, 4½ cwt.

Pack bullock: average weight, 5½ cwt., which includes the load, 1½ cwt.

A cavalry horse with rider weighs about 1400 lbs. This is allowing 18 stone for the rider.

**Welding**—Is described as "the art of joining together two pieces of iron by means of heat. In technical language, this is called *shutting together* or *shutting up*. The operation bears some resemblance to what in carpentry is called *scarfing;* but in smith's work, the joints, also called *scarfs*, do not, from the adhesive nature of the iron when raised to the proper temperature, require any accessories answering to the glue, bolts, straps, and pins, used for joining wooden beams and girders. In joining two cylindrical ends, the scarfs required for the *shut* are made by upsetting or thickening the iron by first hammering its extremities; it is then rudely tapered off to the form of a flight of steps, and the sides are slightly bevelled or pointed. The two extremities are next raised to the welding heat, when a little sand is sprinkled upon each; this fuses and spreads into a kind of varnish, which defends the hot metal from the oxidising influence of the air. The proper heat has been attained when the iron begins to burn away with vivid sparks. Two men then take each one piece, strike them forcibly across the anvil to detach any loose cinders, place them in their true positions for the joint, when they are united by two or three blows of the fireman's hammer, and his assistant completes and finishes off the work with a sledge hammer. The end is next *jumped* upon the anvil and struck endway, to prove the soundness of the joint, or to enlarge the part, should it have become reduced in size by the welding."

A method is stated to have been lately discovered of welding steel to iron. The two surfaces to be welded are slightly wetted, and powdered with a mixture of 1 part of dried borax, 1 part of fine iron filings, and ½ part of prussiate of potash. The pieces of iron and steel are then tightly bound together, either with iron wire or by other means, when all that remains to be done to make a perfect weld is to beat them to a temperature of from 350° and 400° heat (Fahr.), and subject them to blows from a steam-hammer and pass them between rolls. This process, it is stated in the weekly paper, the *Iron*, has been carried out in experiments only.

**Werder Rifle**—A breech-loading rifle, with which the army of Bavaria is armed. It is the invention of Herr Werder.

This rifle is described as a block arm (*arme à bloc*), that is, with a movable breech worked transversely in a metallic box, contained in the wood between the stock and the butt.

The barrel is of puddled steel, with a calibre of 0·43 inch; its length is 2·91 feet, and that of the rifled part 2·72 feet. The whole length of the rifle is 4·26 feet; with sword-bayonet, 6·16 feet.

Its weight is 9·31 lbs.; with sword-bayonet, 11·22 lbs.

It has 4 grooves, with a depth of 0·012 inch; the twist of rifling is 1 in 30 inches. The cartridge is made of metal, and arranged for central fire. Its weight is 555 grains; that of the powder-charge, 66 grains, and of the bullet, 338·9 grains.

The cavalry carbine is constructed on the same principle.

Bavaria is on the point of adopting the Mauser rifle, in order to obtain uniformity in the armament of the whole of the German army. In the meantime the Werder rifle has been converted in such a manner as to enable it to fire a Mauser cartridge. This conversion does not alter in any way the principle on which it is constructed, the charge of powder alone being changed from 66 grains to 77, the same as that of the Mauser cartridge, so as to increase the tension of the trajectory and the range. The sight is graduated to 1312 yards. (*Vide* Appendix F.)

**Werndl Rifle**—A breech-loading rifle, the arm of the Austrian army. The following is a description of this arm. The barrel is of puddled steel, with a calibre of 0·43 inch; its length is 2·8 feet, and that of the rifled part 2·2 feet. The whole length of the rifle is 4·16 feet.

Its weight is 9·87 lbs.; with sword-bayonet, 11·22 lbs.

It has 6 grooves, with a depth of 0·0071 inch; twist of rifling, 1 in 28 inches. The cartridge is arranged for central fire; it is made of *tombac* (an alloy of 93 parts of copper and 7 of zinc). Its length is 2·38 inches; weight, 494 grains; that of the powder-charge, 62 grains, and of the bullet, 321 grains.

In 1874 a committee was appointed to carry out experiments in order to increase the ballistic powers of this rifle. It was decided to adopt a new cartridge, which would give the required range and penetration. This new cartridge holds a powder-charge weighing 76 grains, and a bullet weighing 386 grains. Notwithstanding the increase in the weight of the bullet, the initial velocity is the same as in the former cartridge. A new cartridge has been also adopted for the Werndl carbine; the bullet is the same as that of the infantry rifle, and the weight of the powder-charge is 40 grains. (*Vide* Appendix F.)

**Wet Ditch**, *vide* Ditch.

**Wheel**—A circular frame of wood, iron, or other metal, consisting of a nave or hob, into which spokes are inserted, which sustain a rim or felly; or a solid circular piece of wood or metal, the whole turning on an axle. The wheel and axle constitutes *one of the* mechanical powers. The following explanation of the "object," or "mechanical advantage," of a wheel is given in the 'Treatise on Military Carriages,' by Captain Kemmis, R.A.:—

"With regard to the object of a wheel; suppose a carriage had not wheels, and in that condition was dragged over the ground, in sliding over the surface, much friction would be developed, resisting the motion. Let the carriage be placed upon wheels, and instead of the development of friction between the ground and the carriage, there will be friction of the axle-trees upon the pipe-boxes, but very different to what it was before. For in the first case it was between surfaces over one of which there can be little or no control, namely, the ground, while in the second case it is between surfaces which can be varied and made such, as to material, that the friction may be a minimum and be still more reduced by the employment of grease. Further, the friction acts with less power at the axle-tree, in the proportion of the radius of the axle-tree to that of the wheel. We learn therefore that the primary object of a wheel is to remove the sliding friction, which would otherwise take place between the carriage and the ground, to the axle-tree arms, where it is under control, and where it presents a minimum resistance to motion."

The wheels of artillery and other carriages are composed of three independent parts, viz. the nave, spokes, and felloes, which, when put together, form the wheel, and, when so placed, are kept together by an iron ring or tire. The several parts of the wheel are formed either by hand or by machinery. The tire, which, as explained, forms a band round the circumference of the wheel, is made of wrought iron ⅝ inch thick, and is 3 inches in breadth in field carriages; the pipe or nave box is a truncated cone, divided internally into three parts, the centre of greater diameter than the others, for the purpose of carrying grease. Wheels for artillery light field carriages are all of one diameter, viz. 5 feet; and the wheels of ordinary heavy gun-carriages are the same, but the limber wheels are only 4½ feet. For carriages intended to move more slowly, such as sling wagons, they are from 7 to 11 feet. All gun-wheels have what is termed a "dish," which is the required angle with the nave at which the spokes of the wheel are fastened or driven into it. By inserting the spokes at this angle, a hollowness is formed in the wheel, the spokes not being perpendicular to the plane on which the wheel stands, but having a slope outwards to the nave. The object of the spokes being thus placed is to strengthen the wheel against lateral (side) pressure, the spokes at this particular angle forming so many props, meeting and counteracting the lateral pressure, and as the wheel revolves, each spoke in its turn receives the weight of the carriage perpendicularly. The Madras gun-metal nave, somewhat modified, has been introduced into the service for some years past, and the reader is referred to the heading Nave for a description of it.

Wheels, as shown in Lieutenant-Colonel Owen's 'Modern Artillery,' are divided into four classes—*siege*, *field*, *general service*, and *naval* wheels; and though there are several wheels in each class, differing in weight and diameter, all in a class have the same *pipe-box*, and will therefore fit on the same axle-tree arms.

**Wheel, To**—A movement commonly made by troops. It consists in moving, forward or backward, round some given point, called the pivot, which may either be a *standing* or a *movable* pivot. Books on drill explain how the several *wheelings* are performed.

**Wheel Transport,** *vide* Transport of Troops.

**Wheelbarrow**—A very useful hand carriage for carrying small loads of earth, &c. It is supported on two legs, and has a small wheel in front; it is pushed by one man.

A large number of wheelbarrows are attached to an engineer or artillery train.

**Wheelers**—The shaft horses of a gun-carriage. The term is also applied to the mechanics of a battery engaged in setting up the wheels of the gun-carriages.

**Wheel-lock**—The mechanism formerly attached to a musket; it was the first invention for discharging small-arms without the aid of a piece of match. It may be said to be the origin of our flint-lock. It was an improvement on the matchlock or arquebus, and was invented at Nürnberg in 1517.

**Whip**—A small single tackle; a *whip upon whip* consists of two movable blocks, one of which is applied to and acts upon the running end of the fall of the other.

**Whip, To**—In artillery exercise, to whip a rope is to tie a piece of twine round the end to prevent the strands being laid open.

**Whitworth Gun**—A gun invented by Mr. Whitworth. His original gun was made of wrought iron, having his well-known hexagonal rifling. From accounts given of this gun, it appears to have combined durability with length of range, accuracy, and penetration. Lieutenant Simpson, U.S.N., in his work on 'Naval Gunnery,' published some years ago, describes it as follows:—

"The method of rifling adopted by Mr. Whitworth consists in making the bore of the gun of a hexagonal spiral form, by which rotation is impressed upon the projectile by effective rifling *surfaces* instead of by spiral *grooves* and the non-effective *lands* of a cylindrical bore. The projectiles being of the same hexagonal form externally as the bore is internally, and no forcing process required, metals of all degrees of hardness may be employed. This simple mechanical principle admits of application to fire-arms of every description, provided they are of sufficient strength to resist the strain put upon them by the rifling principle.

"Mr. Whitworth first applied his system to rifle muskets, and with such success as, in all the comparisons made between it and the Enfield rifle, to excel the latter in accuracy and penetration.

"The great strain put upon a gun rifled in the ordinary manner, at the instant of discharge, is occasioned by the force exerted upon the projectile to overcome its natural *vis inertia*, together with the force required to cause the soft metal, of which the projectile is formed, or with which it must be coated, to enter into the grooves of the bore: whereas by the system of rifling by surfaces, and not by grooves, the projectile, not being forced into another form, is more easily set in motion.

"Mr. Whitworth entirely eschews the

method of giving a gaining twist to the spiral of the bore, as obviously dangerous, by causing increasing strains upon the gun in the chase and at the muzzle, just where the diminishing thickness of metal in the gun requires relief; and to which malformation of the Lancaster gun may be attributed the frequent burstings of that gun at or near the muzzle, which occurred in numerous experimental trials, and subsequently happened on service at the attack of Sebastopol, where, on one occasion, the whole muzzle of a gun was blown off by the increasing strains thus put on it; having got rid of which weak part, the gun continued to be used with safety and effect as a howitzer.

"The ball presents many surfaces and points calculated to interfere with its accuracy of flight through the air; it is to overcome this that such a rapid motion of rotation is communicated to the ball; an idea of the rapidity of this motion may be formed by noticing the measure of twist in the 3-pr., the piece from which the most wonderful results have been obtained. In this piece, we have one turn in 3 feet 4 inches, and as the piece itself is only 6 feet in length, the ball is required to make nearly two entire revolutions before leaving the bore; in spite of the great strain that is thus brought upon the gun, it is said to be very strong, and the 3-pr. has been fired fifteen hundred times, chiefly at high elevations, without the gun exhibiting any injury or signs of wear.

"The Whitworth field gun is a breech-loading piece; the arrangement by which the breech is closed consists of a cap screwed on externally; this cap works in an iron hoop, jointed to a projection at the side of the breech, and which, when returned to its proper place, is screwed externally to the breech piece. The shot is first put into the gun through the breech, then the powder in a tin case filling exactly into the hexagonal bore of the gun, having a lubricating wad attached to the forepart of it, which at each discharge sponges out the gun, the tin case remaining in the chamber; the door is then closed, when the cap-screw fits on to its place, and three turns of the screw handle screw it on to the piece. The vent lies in the *centre of the breech* piece.

"The Whitworth guns are all made in masses of 'homogeneous' thin iron, and bored out of the solid. The large guns are strengthened by wrought-iron hoops applied by hydraulic pressure. The projectiles are simple, uncoated, hard metal bolts of various shapes, according to the purpose for which they are employed. They are all made by self-acting machinery, and so nicely shaped that their bearing surfaces fit with the utmost exactitude, the rifling principle being executed by the machinery in the workshop, and not produced by the explosion in the gun. For firing through soft substances and into masonry, tubular projectiles are employed; for piercing thick plates of wrought-iron, flat-fronted projectiles, made of homogeneous iron, are used. For ordinary practice, and where length of range is important, the fore part of the projectile is made to taper slightly, the front being rounded off, and the rear part is made nearly to correspond with the fore with regard to the degree of taper, but its end is flattened, and sometimes slightly hollowed out. In the Whitworth gun, projectiles of any length, and charges of powder of any amount, may be employed. It is said that the Whitworth 3-pr. fired off ten shots, placed one on another; and that a projectile ten diameters in length was fired from a howitzer rifled according to the Whitworth system, without injury to the gun."

Mr. (now Sir J.) Whitworth's system of rifling is applied to both his breech- and muzzle-loading guns. His mode of treating steel by compression renders his guns strong and enduring, and the method of closing the breech appears to be all that could be desired.

**Wicket**—A small door in the gate of a fortified place, affording a free passage to and fro, without opening the great gate.

**Will**—A testament of any individual, giving instructions as to the disposal of his or her property or effects.

Soldiers making their wills while in hospital should, when practicable, get the medical officer to witness their signature, and he is to affix a declaration to such will, stating whether the parties were in a fit state of mind at the time to execute the same.

**Wind of a Shot**—Wind arising from a shot passing close to the body, causing contusion, without the flesh being turned or struck; this occurrence has led to many speculations as to its real cause. That such contusions do take place is undoubted, but whether from the cause explained may perhaps be disputed. The true explanation of the cases formerly attributed to the wind of a shot appears to rest, according to recent views, in the peculiar direction of the shot, the degree of obliquity with which the missile impinges on the elastic skin, together with the situation of the structures injured beneath the surface, relatively to the weight and momentum of the ball on one side, and hard resisting substances on the other. See Longmore's article on "Gun-shot Wounds" in Holme's 'System of Surgery,' vol. ii. pp. 18–20, where the subject is fully discussed.

**Windage**—In artillery, the difference between the diameter of the shot and that of the bore. This definition, Lieutenant-Colonel Owen says, has been objected to, and he defines it as being strictly the difference between the area of a section of the bore at right angles to its axis and the area of a great circle of the shot. The windage allowed for smooth-bore ordnance in the British service is ·1 inch in light guns; ·125 to ·233 inch in heavy guns; ·08 inch in heavy M.L.R. guns; ·16 inch in 13-inch and 10-inch mortars. Windage in a muzzle-loading gun is necessary—(1) that the projectile may enter the piece easily, and that the service of the gun may never be interrupted by jamming; (2) to allow of the expansion of the shot when heated; (3) to admit of the use of a time fuze, which is ignited by the flash of discharge.

**Windgall**—In veterinary practice, an abnormal enlargement from overwork of the little sacs containing fluids, destined to lubricate the complicated tendons of the leg. It was so called from a former erroneous notion that it contained air. Remedy, in bad cases, bandage with ointment; in severe cases, fire. This complaint was formerly very common from bad shoeing.

**Windlass**—An axle or roller of wood, square at each end, through which either cross-holes are pierced for handspikes, or staves are fixed crossways to turn it round; as it revolves, it draws a cord or chain, one end of which is attached to a weight, which is thus raised from any depth.

**Windsor Castle**—Among the fortified places of England in days gone by, Windsor Castle held a conspicuous place. Before the time of William the Conqueror, Old Windsor, about two miles distant from the site of the present castle, was not a fortress, but a palace for the Anglo-Saxon monarchies. The present castle is stated to have been built by William I., and to have been regularly fortified by him. It appears, however, that the history of the existing castle begins in the reign of Henry III. Historians have dealt with the various associations of the spot. Her Majesty makes it, at different times, her residence.

**Wing Officer**—An officer of the Indian army attached to a wing of a native infantry regiment. On the reorganisation of the above army, after the Indian mutiny (1857–58), native regiments were divided into two wings, to each of which a wing officer was appointed, either a field officer or a captain.

**Wings**—The two flanks or extremes of any portion of an army or any body of troops on the right and the left of the centre.

The term *wing* is sometimes used to denote the branch of a crown-work, &c.

**Wire**—A metallic substance drawn to an even thread. It is produced by passing the metal through draw-plates of specific sizes until it attains the requisite thickness.

**Wire Entanglement**, *vide* Entanglement.

**Withes**—Twisted rods for securing the web of a gabion.

**Witnesses**—Persons, civil or military, who are summoned before a court-martial by the judge advocate-general or his deputy, or the person officiating in that capacity, to give evidence on facts with which they are personally acquainted from having been present and having witnessed the circumstances they are called upon to speak to. Witnesses are examined on oath, except such as by law are permitted to make a solemn affirmation.

The following is extracted from 'Elementary Lectures on Military Law,' by Captain Tulloch:—"A witness is first examined by the party producing him; this examination is termed the examination in chief; he is then cross-examined by the adverse party; he may then be re-examined on such fresh matter as may have been elicited by the cross-examination, and finally the court puts such questions as they may deem expedient.

"In the examination of witnesses, leading questions, viz. questions that suggest their own answers, are inadmissible, except in the case of questions which are purely introductory.

"The general rule is that a witness can only be examined as to facts which he personally recollects, and which become known to him by the evidence of his senses, but he may give evidence as to his belief of the identity of a person, or as to handwriting being the writing of a particular individual, although he will not swear positively to the facts."

In the above work will be found a detail of the position of witnesses, and what they are permitted to say or do before a court-martial.

**Wobbling**—The unsteady motion of an elongated projectile through the air, caused probably by uneven resistance, due to a certain variable motion in the axis of the projectile.

This unsteadiness may be caused either by insufficient rotation being communicated in the bore of the gun, or by the subsequent action of the air, the pressure of which causes an instability of rotation, and thus an irregularity in the amount of surface which the projectile presents to the air.

**Wooden Bottoms,** *vide* Sabot.

**Wooden Horse, Riding the,** *vide* Riding the Wooden Horse.

**Woods**—Any place planted with trees. Woods, in warfare, are very advantageous as *points d'appui;* the glades can be made use of to assemble troops, and thus conceal their movements from the enemy, and the skirts form a continuous line of shelter, where a few skirmishers can easily keep a larger body of troops in check. (*Vide* Reconnaissance.)

**Woolding** or **Packing Hitch**—A knot for tightening a *rope. It is* used to secure a load on a carriage, so firmly, that it may travel without loosening. A stick, called the *woolder*, is used in the operation of tightening the knot.

**Woolwich** — A town situated in the county of Kent, on the right bank of the Thames. It is the seat of England's great arsenal, and contains within it the only government gun factory in the country; it is also the head-quarters of the royal regiment of artillery. Woolwich forms the 8th military district, and has no other command than the garrison itself, including the arsenal and all the other establishments connected with that arm of the service. The *Woolwich Arsenal* was formed about the year 1720, and has grown up into a first-class establishment, having within it a gun foundry, as shown above, in which all guns used for the armament of land and naval artillery are manufactured, a carriage department, a laboratory for experiments, a small-arm factory, a factory for casting shot and shell; the ordnance select committee carry on their proceedings there. The gun factory is capable of producing guns in weight amounting to about 6000 tons per annum, of various calibres. The number of workmen (all civilians) for whom employment can be daily found amounts to 1600; but the number of men actually employed depends on the work to be done.

The time required for the manufacture of wrought-iron muzzle-loading rifled guns is generally one week for each inch of calibre. Thus a 7-inch gun requires about seven weeks to manufacture it up to proof. The 12½-inch 38-ton gun and the 16-inch 81-ton gun are exceptions to this rule, and require longer time per inch of calibre. A single gun, however, could not be made in the time named, as this rule is based on the assumption that the guns are manufactured in numbers.

The different departments in the arsenal are each presided over by an officer of artillery, assisted by officers of that branch of the service, under the surveyor-general of ordnance.

Woolwich is, besides, the seat of the Royal Military Academy, for the training of officers for the artillery and engineers, and the principal centre of scientific and practical instruction for gunners.

**Woolwich Gun**—A gun rifled on the French system, with this modification, that the grooves are shallower, and have their corners rounded off.

The present 7-, 9-, 10-, 11-, 12- and 12½-inch guns, made of wrought-iron coils with steel tubes, are rifled after this system, with three or more grooves, according to the calibre of the piece; the practice from these guns, as well as their endurance and penetration, has been most satisfactory; the 7-inch gun especially being a great success as regards its shooting qualities. (*Vide* Appendix B.)

**Woolwich Infant**—The name given to the M.L.R. 35-ton and 38-ton guns, which form part of the armament of the service, more especially for the navy.

Experiments with the 35-ton gun, of 12-inch calibre, as tabulated by Captain Noble, R.A., and showing the capabilities of this gun with the service charge of powder (100 lbs. of pebble powder) and a 700-lb. shot, are herewith given.

With the ordinary backing of hard wood, added to the thickness of the iron target, at 200 yards range, the projectile can be sent through 15 inches of iron; at 500 yards, through 14 inches (the thickness of the *Devastation* turret); at 1700 yards, through 12 inches; at 2600 yards, through 11 inches; at 4000 yards, through 9 inches, and at 4500 yards, through 8 inches. Thus, at a range of over 3 miles, a shell ⅓ ton in weight can be made to pierce the sides of some of the heaviest ironclads in the navy. The dimensions of this gun are as follows:—

| | |
|---|---|
| Length .. .. | 15 feet 11¾ inches |

| | Tons | cwt. | qrt. |
|---|---|---|---|
| Average weight of gun | 34 | 15 | 0 |
| Preponderance .. .. | 0 | 1 | 1 |

| | Inches. |
|---|---|
| Length of bore .. .. | 162·5 |
| Length of rifling .. .. | 135 |
| Calibre .. .. .. | 12 |
| Rifling (Woolwich), No. of grooves .. .. .. | 9 |

Twist increasing from 0 at breech to 1 turn in 30 calibres at muzzle.

The guns of this calibre hitherto made are specially for sea service, and are intended for turrets. The vent enters the bore at 12 inches from the bottom of the chamber, forming an angle of 45° with the vertical plane passing through the axis of the piece.

The 38-ton gun is built on the same principle as the one just described; its calibre is 12½ inches; charge, about 130 lbs. of either pebble powder or a powder made specially for a gun of this size; weight of shot, 800 lbs.; initial velocity, about 1400 feet per second. An 81-ton gun has also lately been manufactured and subjected to proof; its dimensions are as follows:—

| | |
|---|---|
| Length .. .. .. | 27 feet. |
| Length of bore .. .. | 24 „ |
| Calibre .. .. .. | 15 inches. |
| Diameter of chamber .. | 16 „ |

The early tests with this gun were with charges increasing from 170 lbs. to over 300 lbs. The weight of the shot used during these trials varied from 1254 lbs. to 1466 lbs. The gun is now being bored throughout to 16 inches.

The energy of the gun was ascertained to be fully 24,000 foot-tons, and the velocity of the shot was over 1500 feet per second. It is capable of penetrating a 24-inch iron plate.

**Woordie-Major**—The native adjutant of an Indian irregular cavalry regiment.

**Work**—The work performed by any force is measured by the product of the force into the space through which it is exerted. In England, the *unit of work* is called the *foot-pound*, and is that which is performed in raising a poundweight, in opposition to gravity, to a height of 1 foot. The work required to raise 5 lbs. to a height of 10 feet, therefore, is 50 *foot-pounds*. (*Vide* Energy.)

**Work Done**—In gunnery, as explained by Captain (now General) Boxer, denotes a certain pressure exerted through a certain distance. It is measured by the product of the pressure, and the distance through which this pressure acts; the element *time* does not necessarily enter into the expression.

**Working Parties**—Men told off from each regiment, when necessary, to carry out work in and about a camp as may be ordered by the general for the safety of the camp, such as throwing up works, clearing the camp, levelling trees, &c., indeed, all work where the use of the spade and pickaxe is as essential as that of the rifle and bayonet. Such duties do not entitle officers or men to working pay or any other remuneration. The Queen's Regulations, however, state that when men are employed as artificers or labourers on permanent military works, public roads, &c., they may be granted a working pay in addition to their ordinary military pay.

**Works**—In fortification, all work done to fortify a position, or for the attack or defence of a fortified place.

Works are either *permanent* or *field;* the latter are enclosed or open, according as their parapet does or does not entirely surround the site occupied. Redoubts and forts are called enclosed, redans and lunettes open works.

**Worship** — The act of paying divine honour to the Supreme Being. The Articles of War enjoin on all officers and soldiers the necessity of attending at divine service, according to the persuasion of each. Without just impediment, no officer or soldier can absent himself from the place appointed for the assembling of the corps to which he belongs, or, when there, behaving himself in an indecent or irreverent manner, without rendering himself liable to be tried by a court-martial. The Queen's Regulations direct that an officer is to march the Roman Catholic and Presbyterian soldiers to church when their number shall exceed 20; under that number, the men will be in charge of a sergeant. The officer or sergeant is to remain with his men during the performance of the service.

**Worsted**—Defeated; overthrown; put to the rout.

**Wound, A**—The breaking of the continuity of the parts of the body. Wounds are caused either from gun-shot, bullets, or from *arme blanche;* some are of a simple nature, and are termed slight wounds. Those of a complicated nature are termed bad wounds, and men so wounded are said to be *badly wounded.* Some wounds may become mortal; hence the term *mortally wounded,* that is, where death is inevitable. A record of a soldier's wounds is to be inserted in his discharge certificate, and an entry of them made in his pocket-ledger.

**Wounded**—Such officers and soldiers of an army as have been maimed or hurt in action. For the care of the sick and wounded, *vide* Ambulance; also, Sick and Wounded.

**Wrench**—An instrument for screwing or unscrewing iron work. The *general service knock-up* wrench consists of two claws and a bar, the upper one formed in one piece with the bar and the lower one sliding; the latter is fixed at any required distance from the upper by means of an iron wedge.

**Wrought Iron**—A metal obtained from cast iron by burning out the impurities in the process of "puddling"; by rolling or drawing it out under a hammer, it is given a fibrous structure, the fibre running along the bar just as the fibre of wood runs along the stem and branches of a tree. Wrought iron is valuable as a gun material, on account of its comparatively high tenacity, combined with its malleability and ductibility. Should the elastic limit be exceeded and the iron become permanently extended, the two latter properties come into play, and give a large margin of extension before the limit of tenacity is reached and the metal breaks. For this reason, it is preferred to steel for the outer coils of guns.

**Wurst** or **Car Battery**—A kind of carriage used by the French, in 1791, with the view of improving the mobility of field batteries. As described by Captain Hime, R.A., F.R.S., in his lecture before the Royal Artillery Institution at Woolwich, the "wurst" was a two-wheeled ammunition carriage resembling in a general way an Irish jaunting-car; the gunners sitting in two rows facing outwards, with the ammunition between them. Besides the danger incurred in bringing these cars under fire, they had another objection, that of constantly upsetting on the slightest inequality of ground or obstacle coming in the way.

Car carriages were adopted in the English artillery in 1803, but after a few years were discarded. Their use led to the introduction of a better sort of ammunition carriage, the want of such being felt by the officers of the artillery.

The ammunition carriage thus introduced was on four wheels, and similar to our present ammunition wagon.

## Y.

**Yard**—A measure of 3 feet. The English standard yard of 1760, lodged in the custody of the Clerk of the House of Commons, is made the standard or unit for all measures of extension whatsoever, and $\frac{1}{36}$ of such yard = 1 inch.

**Yarn**—Wool, cotton, flax, &c. spun into thread. It is used sometimes in binding fascines. Its quality is expressed in English by numbers denoting the number of hanks in a poundweight (avoirdupois); reckoning the length of the hank of cotton yarn at 840 yards, or 7 lengths of 120 yards each.

**Year, Sidereal** — The time occupied by the earth in moving in its orbit, or apparently the sun in the ecliptic, from a determinate point in relation to any fixed star to the same point again; it consists of 365 days, 6 hours, 9 minutes, 12 seconds.

**Year, Solar** or **Tropical** — The time taken by the earth in moving in its orbit, or apparently the sun in the ecliptic, from one equinox or tropic to the same again; it consists of 365 days, 5 hours, 48 minutes, 49 seconds.

**Yeomen of the Guard** — Popularly known as the *Beef-eaters;* a term derived from the French *beauffetier*, "an officer appointed to watch the buffet, or sideboard, partially derived from the circumstance that some of them originally were ranged at table on solemn festivals." They form a body of old soldiers, 100 strong, employed about the person of the sovereign on great or state occasions, in conjunction with the gentlemen-at-arms.

The yeomen of the guard were constituted a corps in 1485 by Henry VII.; they wear the clothing of the period of Henry VIII. The officers of the corps are a captain (ordinarily a peer), a lieutenant, an ensign, and four exons. There is also a "clerk of the cheque and adjutant."

**Yeomanry**—The collective body of yeomen or freeholders possessing land of their own. The yeomanry owes its origin to the time when, during the revolutionary wars of France, England was threatened with an invasion from that country. It comprised, then, infantry as well as cavalry, but after the peace of 1814 the infantry portion and many of the cavalry corps were disbanded. What is now known as the yeomanry cavalry of Great Britain is chosen from among the gentlemen and yeomen of each county. They are volunteers, but are liable to be called out in aid of the civil power. They receive an allowance of £2 per man per annum from the government for clothing; they are provided with arms, but each man has to feed his own horse, except during the annual training time, when he receives 2s. a day for forage and a subsistence allowance of 7s. a day. In case of invasion, or a threatening of invasion, they would have to assemble for actual service, and be liable to be sent to any part of Great Britain, and, while so embodied, would then be subject to the Articles of War.

The constitution of the yeomanry is regulated by 44 George III. cap. 54 (Volunteers Act of 1804) and the Yeomanry Regulations of 1864.

The yeomanry is organised into local troops; no troop to consist of less than 40 or more than 100 men; regiments to consist of 4 to 8 troops. The regular army provides an adjutant for each regiment and a drill sergeant for each troop. The troopers are not enrolled for a certain number of years, but are able to quit at any time on 14 days' notice. In many regiments, however, they bind themselves to serve 3 years, under a penalty of £5. Each yeoman is required to attend, yearly, 9 drills, and recruits 12 drills; they then receive each day 2s. per man, and 1s. 4d. per horse.

They assemble on permanent pay and duty 6 days in the year, and receive 7s. a day to cover every expense. When so assembled, they are subject to the Mutiny Act.

The yeomanry form 42 corps of 233 troops; total number about 15,000. (*Vide* Appendix F.)

**Yield, To**, vide **Surrender, To.**

**Yokes** — Consist of two wooden bars, an upper and lower bar connected by two iron rods, at a distance equal to the depth of the largest-sized bullock's neck, and about a fourth of the length from each extremity of the bar. Near the extremities of the wooden bars are two movable iron rods, fastened by rings, which can be disengaged when the bullock is being put to or yoked in. On the upper bar, a clip band and swivel are fastened for the purpose of attaching the yoke to the pole. Yokes are required for bullock draught, and are used either for pole or trace. The clip band is attached when used as a pole yoke.

In India, bullock draught is extensively used in all departments of the army.

**York's School, Duke of,** *vide* Schools, Military.

## Z.

**Zenith** — That point in the heavens directly over our heads. The zenith to us is the nadir to our antipodes. Circles drawn through the zenith and nadir of any place, cutting the horizon at right angles, are called azimuth or vertical circles.

**Zero**—The point on a scale marked 0 or nothing. In the graduation of a thermometer, such as Réaumur's and the Centigrade, the zero point commences at the freezing-point of water. In Fahrenheit's scale, the zero is placed at 32° below the point at which water congeals, being about the temperature of salt and snow. (*Vide* Thermometer.)

**Zigzags** — In fortification, trenches pushed on during a siege towards the place besieged. The trenches are constructed in a zigzag direction, so that, when prolonged, they shall fall clearly without all the defensive works, that they may not be enfiladed. (*Vide* Approaches.)

**Zinc**—This metal, in commerce frequently called "spelter," was first mentioned by Paracelsus, in the fifteenth century, under the name of *zinetum.* It does not occur in the native state, but is obtained from its ores, which are chiefly the sulphuret and carbonate of zinc. It has long been imported into India from China. The name *tutenague,* by which Chinese zinc was known in commerce, is evidently derived from the Tamíl word *tutanagum,* and it was at one time called Indian tin. The ores of zinc were, no doubt, employed by the ancients in making brass. Zinc ($Zn = 32$) is found in the state of an oxide, but principally as a sulphuret (*blende*) and an impure carbonate (*calamine*). From both ores it is converted into an oxide by the process of roasting, and then reduced to the metallic form by the aid of carbonaceous matter, when it may either be fused or sublimed. Until purified by a second distillation, it contains as impurities small portions of other metals, as iron, copper, arsenic, &c. In the corrugation of iron, zinc is the metal used. It was also used, not very long since, as an alloy in the manufacture of shot studs for the smaller natures of projectiles.

**Zinc Plates**—Plates of metal used with Professor Grove's voltaic battery, in mining. They are made of the purest rolled sheet zinc, and then coated with quicksilver, which preserves the surface, in a great measure, from being destroyed by the action of the sulphuric acid in which the plate is steeped.

**Zone**—In geography and natural history, a band or strip running round any object.

As applied to fortification, the *zone of defence* signifies a belt of ground in front of the general contour of the works within effective range of the artillery on the ramparts. Should the zone of defence be wooded and inhabited, one of the first duties of the defenders would be to clear it of all trees, houses, &c., in one word, of everything that may impede the fire of the guns or be made use of by the enemy as places of concealment.

*Zone of fire,* a term synonymous with range or trajectory (*q. v.*); the dangerous zone is that space of ground which is rendered so to troops in the field by the projectiles having their full effect upon them. It differs in small-arms, and depends in guns on the initial velocity and the angle of elevation. The French call *zone morte* the space of ground where the projectile has lost its strength, and is spent.

*Zone of operations.*—The territory that contains the lines of operation, or lines on which an army advances, between the base and the objective.

**Zone Energy**—This is a mode of expression in artillery whereby the relative power of different guns as armour piercers is estimated, viz. by the number of foot-tons per inch of the shot's circumference. At the muzzle of each gun, this power is a *maximum*, but owing to the resistance of the air it gradually diminishes during the shot's flight.

**Zouaves**—A body of troops originally raised in Algeria, and composed of Frenchmen and Algerians of the tribe of Kabyles in certain proportions, and officered from both races. This commingling of the two races was found not to answer, and gradually the native element was eliminated, and the force of *zouaves* was eventually nothing more than Frenchmen in a Moorish dress. They are recruited from the veterans of the ordinary infantry regiments, who are distinguished for their fine *physique*, tried courage, and hardihood. (*Vide* French Army.)

# ADDENDA.

## A.

**Absence**—A state of being absent. ny absence from duty without permision for a period not exceeding twentyur hours is punishable; if the absence oes not exceed five days, the soldier subects himself on his return to duty to eprivation of pay, or to be tried by courtartial. After that time, absence is reated as desertion and punished as such.

When an officer or soldier absents himlf, or, in other words, does not rejoin is regiment at the expiration of his ave, he is reported *absent without leave.* f sickness or some other legitimate cause as prevented him from rejoining, he ust apply for an extension of leave, rough the channel of communication id down in the regulations.

**Absentee**—A soldier absent from any arade, roll-call, or duty, at which he ught to be present.

**Allowance**—Money granted in addion to the regular pay of an officer or ldier for some particular purpose, or a regiment to meet certain expenses.

For instance, what is termed *colonel's llowance* is granted to general officers in e British army when selected by the mmander-in-chief to fill the post of colonel of a regiment"; this takes lace when vacancies by death occur. a the Indian staff corps, the colonel's llowance is granted to each officer fter a stated period, viz. 38 years' rvice, provided he has served 12 years the rank of lieutenant-colonel. (*Vide* ff-reckonings.)

*Lodging allowance* is granted to officers, on-commissioned officers, and men, when ccommodation cannot be provided for hem in barracks; it includes *fuel and light allowance.* The two latter allowances are granted to officers, irrespective of lodging allowance.

Agreeably to a late warrant, the allowance granted to non-commissioned officers has been fixed as follows :—

| | | |
|---|---|---|
| Class I. | .. .. | 1s. 9d. a day. |
| „ II. | .. .. | 1s. 0d. „ |
| „ III. | .. .. | 0s. 6d. „ |

A non-commissioned officer on the married roll continues to receive lodging, fuel, and light allowance for the benefit of his wife and family when he may be in hospital or temporarily separated from them, on service, provided no married soldiers' quarters become available for their use.

*Horse allowance* is granted to officers when forage has not been issued by the commissariat.

*Contingent allowance* is granted for any particular expenditure permitted by the regulations.

*Servants' allowance* is given to certain officers who are not allowed soldier servants.

*Field allowance* is passed to officers to enable them to provide themselves with baggage animals and equipment in the field.

The term *allowance* is also applied to the amount of rations, forage, &c. served out periodically to any one man or to a body of men. (*Vide* Queen's Allowance.)

**Army List**—A monthly publication issued by the War Office. It contains the names of all commissioned officers of the army, including the Indian army, marines, the civil departments, the militia, and the volunteers, enumerated alphabetically and by regiments; it gives also a list of all officers retired on full and half-pay.

Another similar work, but not of an official character, is Hart's 'Army List,' published quarterly, giving, in a condensed form, the same information, with the addition of the services of every officer.

## B.

**Besieging Army**—An army detached or sent for the direct and immediate purpose of laying siege to a town or fortified place, in order to capture it by the regular process of siege works. (*Vide* Siege.)

**Blockading Army**—An army, either independent or auxiliary to a besieging army, which is employed to invest a town or fortified place, in order to intercept all communication from without and to reduce it by famine.

**Breech Action**—The mechanism of breech-loading rifles, by means of which the rifle is loaded and fired.

The adoption of breech-loading rifles gave birth to different systems of breech action, differing from each other, or simply improvements on the former systems, and which now divide these arms into two kinds, viz. bolt arms (*armes à verrou*) and block arms (*armes à bloc*). In the bolt arms, the movable breech works on the axis of the barrel, and shuts by means of a lever, pushed and lowered. Among the best known rifles, the breech of which is constructed on the bolt system, are the Beaumont, the Vetterli, the Gras, and the Mauser. The latter is the last modification of the bolt system. It is "a self-cocking arm, with four motions, open, load, close, and fire. The opening is effected by raising the handle of the breech-bolt to a vertical position and then drawing it back. This compresses the spiral main-spring and cocks the arm. The breech-bolt is divided into two parts, to the hinder of which the firing-pin is attached, while the fore part contains the spiral main-spring. These parts are joined by two interlocking cam surfaces, which move on each other when the bolt is turned round, and separate the parts till the firing-pin end is caught by the sear. When the bolt is turned back to its place, the firing-pin is free to move forward, without any resistance from the cam surfaces, whose curves are now opposite to each other, and can enter without friction. A movable front piece, called the recoil-back, moves with the bolt, but does not turn with it, and thus serves as a safeguard against accidental discharge, as the pin can only pass through it when the gun is cocked and the bolt fully home."

In the *block arms*, the movable breech is worked transversely in a metallic box, contained in the wood, between the stock and the butt. The Peabody is the original block arm, but many modifications have been made in that system, which have given birth to the *falling block*, such as in the Martini-Henry (*q. v.*); the *segment block*, adopted for the Remington, the *sliding block* of the Westley-Richards, and the *hinged block* of the Springfield and of the Werndl (*q. v.*). (*Vide* Appendix F.)

**Brittleness**—In metallurgy, the tendency of certain metals to break more or less readily, under compression, either gradually or suddenly. Cast iron is brittle; hence its unsuitableness for the heavy guns of the present day.

**Broughs**—Gang-boards for embarking horses; they have planked sides 3 feet high.

**Bugle**—A wind instrument without keys. It is made of copper, and used in all dismounted regiments to sound the calls, whether at drill or in cantonments. This instrument, known by the name of *bugle-horn*, is of Saxon origin.

**Bungalow** — An Indian name for a house, the roof of which is covered with thatch. The houses so built form, for the most part, the quarters of officers in a cantonment. They are of different sizes, and vary in rent to accommodate the means of the smallest paid officer.

**Button** — In artillery, the projecting knob behind the breech of a gun; it has generally a cylindrical hole through it, called the "breeching loop."

## C.

**Cadence** (French)—The number of steps soldiers march in a minute, and regulated by precision. (*Vide* Step.)

**Canneluro** (French) — Chamfering, channelling, fluting.

**Cant** — Phrases made use of by a certain class of people, in other words slang. James, in his 'Military Dictionary,' mentions that cant, or slang, was very common formerly amongst the soldiery, and it prevailed differently in different corps amongst the men.

**Centralisation**—In military affairs, a system of organisation or of administration by means of which all matters appertaining to the army are directed by one centre. The legitimate application of the term is to a state of change from local to central management, nd therefore the opposite of localisation. This system, when adopted in the administration of an army, is very dangerous, as it takes away the independence of action of the different officers under the commander-in-chief, and leads to favouritism; and, should the mainspring of the machine break down, all the works come to a standstill. In England, the administrative military authority, although centralised in the crown, has been placed under the control of parliament, and there is nothing done under the orders of the War Office for which the secretary of state for that department may not at any time be called to account by parliament.

**Chaplain-General**—As the name implies, the chief of the military chaplains. The appointment of such an officer was first made by the late Duke of York when commander-in-chief. The recommendation of chaplains to the several garrisons is made by him to the minister of war.

**Chatham**—A fortified town and naval arsenal, in the county of Kent, situated on the right bank of the Medway, and 30 miles from London. Chatham forms the head-quarters of the 5th military district, comprising Sheerness and Gravesend, and would in case of mobilisation of the army be the head-quarters of three divisions (Chatham, Sheerness, and Tilbury) of the garrison troops. The lines of detached forts connected with Chatham constitute a fortification of great strength; they form a flank defence for London in the event of an invader marching on the capital from the south coast.

Chatham is the head-quarters of the royal regiments of engineers and marines. It possesses barracks for infantry, marines, and artillery; a school of instruction for the engineers (*vide* Schools, Military); an institution (*q. v.*), and a library. Every year, practical instruction is given in engineering, siege operations, torpedoes, &c.

**Clinching** — A method of fastening large ropes by a knot and seizings; it is used for the breeching of guns, for attaching the standing end of the fall to the block in tackles, &c.

**Colonial Allowance** — An allowance granted to British regiments in certain colonies to meet the extra expenses of foreign service. The amount varies with the colony; in some it is half as much more as the ordinary pay, in others it is more.

The names of the colonies at which a colonial allowance is granted are the Mauritius, Ceylon, Straits, China, West Indies, Africa, Cape of Good Hope.

No such allowance is granted to regiments in Canada. Australia and New Zealand have no British troops.

The only advantage enjoyed by troops in the Mediterranean is the issue of "extra rations." Regiments in India receive Indian pay.

**Commissariat Department** — While this work has been going through the press, a warrant has been issued by which the control department has been abolished; and all its branches, except the *pay sub-department*, have been reclassified and divided into—

*a*. Commissariat and transport department,

*b*. Ordnance store department,

placed under the direction of the surveyor-general of ordnance.

Its organisation is laid down as follows:—

"I.—ORGANISATION.

"1. All officers of the commissariat and transport department and of the ordnance store department shall hold commissions from us.

"2. Officers of these departments shall be the officers of and shall command our army service corps.

### "II.—RANKS.

"3. The ranks of the officers of the respective departments shall be as follows:—

Commissary-general;
Deputy commissary-general;
Assistant commissary-general;
Commissary;
Deputy commissary;
Assistant commissary;
Sub-assistant commissary.

### "*Relative Rank.*

"4. The relative rank of these officers shall be as follows:—

| | |
|---|---|
| Commissary-general | With an army in the field, special;<br>Otherwise, as major-general; |
| Deputy commissary-general .. .. | As colonel; |
| Assistant commissary-general .. .. | As lieutenant-colonel; |
| Commissary .. .. | As major; |
| Deputy commissary | As captain; |
| Assistant commissary | As lieutenant; |
| Sub-assistant commissary .. .. | As sub-lieutenant; |

and such relative rank shall regulate their quarters and military allowances, including pensions for wounds, and pensions and allowances to their wives and families, except in the case of a sub-assistant commissary, who for these purposes shall rank as lieutenant.

### "*Appointment, Promotion, Retirement, &c.*

"5. Appointments to the commissariat and transport department and to the ordnance store department shall be conferred upon such officers, non-commissioned officers, and civilians, as may be recommended to us by our secretary of state.

"6. Candidates shall be subject to such educational examination as our secretary of state may from time to time determine.

"7. Sub-assistant commissaries shall be liable to be removed from our service for moral or physical unfitness, or if they fail to make satisfactory progress in qualifying themselves for permanent service in the department.

"8. Sub-assistant commissaries, after 2 years' satisfactory service as such, may receive commissions as assistant commissaries. Those officers who may have been appointed from our army shall resign their commissions as combatant officers upon receiving commissions as assistant commissaries.

"9. Service as sub-assistant commissary shall count towards retirement from the higher ranks of the respective departments.

"10. The periods of service towards retirement specified in article 17 shall be applicable to officers of the commissariat and transport department or of the ordnance store department, and in the case of officers promoted from the ranks shall include service in all grades, but not less than one-half of such periods shall consist of service as a commissioned officer.

"11. Officers of the rank of deputy or assistant commissary shall be selected for the appointments of adjutant and quartermaster in our army service corps.

"12. Combatant officers, while under probation, may at any time be ordered to return to their regiments.

"13. An officer shall be eligible for promotion to the under-mentioned ranks if he shall have served on full pay for the following periods, dating from his first entrance into our service:—

"To the rank of commissary-general, 13 years, of which at least 3 shall have been as deputy commissary-general.

"To the rank of deputy commissary-general, 10 years, of which at least 3 (including probationary service) shall have been as assistant commissary-general.

"14. If, during active service, a temporary augmentation of the commissariat and transport department or of the ordnance store department shall become necessary, the general officer commanding may grant to officers of those departments permission to hold temporarily the higher rank in which they may in such an emergency be called upon to act, or may temporarily appoint combatant officers, reporting his proceedings for the approval of our secretary of state.

"15. A combatant officer so appointed

shall receive the pay and allowances of the departmental rank in which he shall be employed, in lieu of all other emoluments.

"16. Officers shall be allowed to count their previous departmental or combatant service as service in the commissariat and transport department or in the ordnance store department.

"17. Officers who shall have completed a total full-pay service of 30 years, including previous departmental or combatant service, shall, on giving six months' notice, have an unqualified right to retire on retired pay. It shall, however, be competent to our secretary of state to place officers on the retired list after a meritorious service of 20 years, including departmental or combatant service, if by reason of mental or bodily infirmity of a permanent nature (to be certified by a medical board), contracted by the service, they shall be unfit for further duty; or in case of reduction of establishment, or retirement under the provisions of articles 18 and 19.

"18. The retirement of officers who have attained the rank of assistant commissary-general, or who are above that rank, shall be compulsory at the age of 60 years.

"19. The retirement of officers below the rank of assistant commissary-general shall be compulsory at the age of 55 years." (*Vide* Appendix O.)

**Concave Order** — An order of battle described by Colonel Hamley, in his 'Operations of War,' as being "merely a variety of the enclosing angle [*vide* Re-entering Order of Battle], or rather it generally resolves itself into the order echeloned on both wings. To await in such order an equal enemy formed on a straight front, would be to offer both flanks to his attacks. In assuming it, it would be indispensable, therefore, that the flanks were rendered perfectly secure by the nature of the ground. In such a case the position would be extremely difficult to assail, whether on the protected flanks or the retired centre. As an adversary would scarcely enter such a trap with his eyes open, the flanks might be connected directly by a thin line of troops forming an apparent or false front, and veiling the real centre while inviting the attack."

"To attempt to *turn an enemy on both flanks*, refusing the centre, would produce an order of this kind; if attempted *with equal numbers*, it must break the continuity of the line, and could only be justified if the intervals or weak portions were rendered, by obstacles or fortifications, strong against counter-attack."

**Concentration**—Collection into a narrow space round a centre. In strategy, the collecting on a certain point of the different bodies forming an army, to meet the enemy with the greatest number of men possible. For a general to divide his forces, unless for special purposes, is to court defeat in detail. An instance of this is afforded by the war of 1870–71, when the French, divided into 6 separate *corps d'armée*, incapable of supporting each other, were defeated piecemeal by the Germans, who had concentrated all their forces into three powerful armies.

**Concentric**—Having a common centre. This term in warfare is applied to a covering army operating from a common centre against widely separated bodies of the enemy advancing towards that centre; hence it becomes a concentric army. The invasion by the enemy may take place either on one or two lines. Colonel Hamley, in his 'Operations of War,' shows the steps which should be taken by a covering army against one or two lines of invasion. In the latter case he thus writes:—"To operate methodically, and to the best advantage, the covering army, if assailed on two lines, should place on each of these a retarding force at first, considering these as wings, while the mass in reserve is held ready to give a preponderance to either wing, or to both in succession. In all Napoleon's operations against a divided enemy this principle is apparent."

**Convex Order** — An order of battle; another variety of the salient; but, as Colonel Hamley, in his 'Operations of War,' remarks, "it may be said that there is no such thing as the convex order, since an army would scarcely draw up on an arc, and that what is meant by the expression is, generally, an order echeloned on the centre, or some other angular form. And it may be asked why, being generally so disadvantageous, it is ever adopted. The answer is that circumstances sometimes render it inevitable; after crossing a river for instance, on an enemy's front, it is necessary to push a part of the army forward to cover the passage, and other bodies up and down the stream to prevent the first from being cut from the bridges. . . . Again, a rear guard covering the retreat over a river or through a defile must often form in this way. The best remedy will be to post the angle of the salient strongly, or, if possible, fortify it with fieldworks; and, in case of a river, the flanks may be protected by batteries on the further bank."

**Covering Army**—An army detached to cover a retreating force, or to protect the different passes which lead to a principal object of defence; it is then stationary, encamped, or in cantonments.

## D.

**Ductibility**—In metallurgy, the property of permanently extending or drawing out by traction, as in wire-drawing. Such metals as gold, silver, platinum, and iron, stand at the head of the list of ductile metals.

## E.

**Elasticity**—In metallurgy, this term applies to certain metals which may be elongated by tension, pressure, traction, flexion, or torsion, without remaining permanently altered on the removal of the strain. The *elastic limit* is the weight that can be applied to a bar of metal, a square inch in area, without permanently altering its form.

## F.

**Filter**—An apparatus, generally made of casks, for purifying water. It is commonly used in barracks to free the water of all extraneous matter.

In India, the apparatus is very simple; it consists of three chatties (earthen vessels of water) placed in a wooden frame one above the other. The two top chatties are filled partially with sand and charcoal, and have a small hole in the bottom of each to enable the water to percolate through; the bottom chattie is the receiver of the filtered water.

**Furlough**—Under this head, in the body of the book, it has been omitted to state that, since the Indian furlough rules of 1868, new rules have been issued, known as the rules of 1871 and 1876, being addenda to those of 1868, whereby an officer by the last named rules can take furlough to England after 5 years, instead of 8, as formerly, and is allowed to enjoy 3 consecutive years' leave in England, retaining half Indian pay and allowances, the rate of exchange being regulated by the Secretary of State for India; officers, however, who elect these rules cut themselves out of the chance of ever getting 2s. for the rupee when in England.

It is optional with officers to take the rules of 1868 or 1876; in the former case they would be paid at the rate of 2s. the rupee, provided they had taken furlough before the rules of 1871 were issued.

## G.

**Gas Checks**—Wads or other means used to stop the destructive escape of gas over M.L.R. projectiles, and to prevent injury to the bore from "scoring."

**Gras Rifle**—The Chassepôt rifle, modified by Major Gras, and now the arm definitively adopted by the French army.

The barrel of the Chassepôt has been retained in the conversion, keeping the same calibre of 0·433 inch, with four grooves from right to left, with one turn in 21½ inches. But in the new barrel the depth of the grooves is slightly diminished, and the ledges rounded off. The same calibre has been retained in order that the same cartridge may be used in all arms. A metallic cartridge has been adopted, in lieu of the "self-consuming" one used for the Chassepôt; the bullet is of compressed lead, consequently the densest and most homogeneous. Its diameter at the base is 0·429 inch, instead of 0·468 inch, in order to reduce, within the smallest limits, the enormous friction the bullet undergoes in the barrel, which considerably diminishes the initial velocity. Thus the bullet of the Gras rifle, being smaller than the bore, is forced by depression, whilst in the Chassepôt it is forced longitudinally. This diminution of friction, combined with the removal of the "chambre ardente," or space behind the cartridge in the old rifle, has produced this effect, and the initial velocity, which was 1365 feet in the Chassepôt, has attained 1491 feet in the new arm. The length of the bullet is 1·092 inch instead of 0·995 inch as formerly, that is, two and a half calibres. A greased wad is placed between the powder and the bullet. The bullet is covered with a strip of paper, in order to prevent *leading*, that is, deposits of lead in the grooves, which are fatal to accuracy.

The barrel of this converted weapon has been modified in such a manner as to enable it to receive the new cartridge; 1st, by an alteration in its calibre; 2nd, by the removal of the *tête mobile*, or movable head, in the breech mechanism, and by a modification of the cylinder, whereby the cartridge fits in closely; and, lastly, by the substitution of a striker or piston for the needle, and by the addition of a stronger spring and a cartridge extractor. The breech action remains, as before, on the bolt principle.

The conversion of the Chassepôt to the Gras rifle is computed to cost 10 francs a piece. (*Vide* Appendix F.)

## H.

**Heavy Cavalry**—In the body of the book it is stated that what are termed the *heavies* form a body of 7 regiments of dragoon guards. This is a mistake; they formerly did, but there are only 4 regiments now, composed of the 4th and 5th Dragoon Guards, the Royals, and the Scots Greys. The men of the heavies are larger men than they used to be, and do not take Indian duty, whereas the rest of the British cavalry do.

## I.

**Indicator Ring**—A thin narrow ring of wrought iron, fitted on the breech-screw of a B.L. gun, with a raised line of brass on it, which shows by its coincidence with a similar line on the top end of the breech-screw whether the vent is properly screwed up. (*Vide* Tappet Ring.)

**Interchangeable** — The meaning of this word is self-evident, viz. that which may be given and taken mutually. In military *matériel*, the term is used to express that an article which suits or fits any part of a machine, a lock of a gun, a wheel, &c., will fit corresponding parts of a like article; and thus all parts of *matériel* are for the most part made interchangeable.

**Invalid Establishment**—An establishment in the Indian army for the transfer of officers who may be declared to be unfit for further service. It consists of—

1. The Invalid Battalion: for officers who, although disqualified for further active service, are still equal to the discharge of garrison duties.

2. The Invalid Pension List: for officers disqualified for both active and garrison duties, either from age, wounds, or decline of health. They are transferred to this list, as stated in the government order, "provided their conduct and habits are such as not to affect the character of that institution, which is designed as an honourable retreat to the worn-out or disabled but deserving officers." The several orders issued on the subject of this establishment will be found in the regulations applicable to the European officers in India, part iii., by the late G. E. Cochrane, assistant military secretary, India Office, and in the orders issued by the government of India.

## K.

**Keckle, To**—To twine a small rope round a cable or bolt rope, to prevent injury from friction.

## L.

**Lines of Communication**—Such lines, or means of communication, as a general keeps up with his base and with his several corps and divisions.

**Localisation**—The act of establishing troops, depots, magazines, &c., in any appointed place, dividing them into a number of small centres independent of each other. In case of mobilisation of an army, each appointed town forms a place of rendezvous, where men on furlough and those belonging to the reserve meet to obtain their arms and equipment, and to be drilled until they are draughted into the regiments in the field or join the army of reserve.

**Lock**—The mechanism of a] rifle or pistol, by means of which the powder is ignited and the arm fired.

It was towards the end of the fourteenth century that the old system of firing muskets by means of a slow-match was discarded and a lock adopted; the new arm took the name of *matchlock* (*q. v.*). This again was replaced by the *wheel-lock* (*q. v.*), introduced at Nürnberg in 1517, and in the seventeenth century the *flint-lock* (*q. v.*) was found to be superior to either. This lock continued in general use until the introduction of the *percussion-lock*, which is still in use among nations that have not yet adopted breech-loading rifles. The principle of this lock is the production of fire by the falling of a hammer upon a cap containing detonating powder, the explosion of which fires the charge in the barrel of the gun. This hammer is set in motion by means of a trigger in conjunction with a spring.

With the introduction of breech-loaders, a new action of the lock was adopted; that invented for the original needle-gun and also for the Chassepôt had the hammer replaced by a direct-acting needle, which exploded the powder by being driven into a percussion cap placed in the heart of the cartridge by the action of a spiral spring within the breech-lock.

A metallic cartridge having been adopted for all breech-loading rifles, the needle has been replaced by a fire-pin or piston, which is driven into the percussion cap, placed at the base of the cartridge, as shown in the Martini-Henry rifle.

**Long Service**—The maximum period a recruit can enlist for in any branch of the service, viz. for 12 years. He may, after accomplishing this service, re-enlist for a further period. (*Vide* Appendix I.)

## M.

**Manganese-bronze**—An alloy of bronze and manganese. Manganese is one of the heavy metals of which iron may be taken as a representative. It is of greyish-white colour, and so hard that it can scratch glass and steel; it is only fused at white-heat. It has long been known to improve the quality of steel, and is used in the Bessemer process. Mixed with bronze, according to a process invented by Mr. P. M. Parsons, it forms a metal capable of absorbing the oxygen, which otherwise would attach itself to the molecules of tin and copper, and thus gives bronze a durability it did not possess when used alone. Besides purifying the bronze from the presence of oxides, the manganese unites with the metal, and affects its character according to the degree in which it is present. This new alloy can be easily forged, and seems to give industry an entirely new metal.

The use of manganese-bronze has been

advocated for screw propellers, axle-boxes of locomotives, high-pressure pumps, and for armour plates. In the latter case, the probable cost of this alloy has been computed to be, weight for weight, 50 per cent. more than the present rolled iron plates. Whether it can be introduced for the manufacture of guns is still under consideration.

**Medical Department**—While this work has been passing through the press, the terms and conditions of service in this department have been altered. By a new warrant, officers joining the medical department are to be governed by the following rules:—

1. Pay. (*Vide* Appendix O.)

2. The pay of officers shall be issued monthly in arrear.

3. The relative rank of the officers of the army medical department shall be as follows:—

i. A surgeon-general shall rank as major-general, according to the date of his commission.

ii. A deputy surgeon-general shall rank as colonel, according to the date of his commission.

iii. A surgeon-major shall rank as major, according to the date of his commission; after 20 years' full-pay service as surgeon and surgeon-major, he shall rank as lieutenant-colonel, but junior of the latter rank.

iv. A surgeon shall rank as lieutenant, according to the date of his commission; and, after 6 years' full-pay service, as captain, according to the date of the completion of such service.

4. The relative rank of these officers shall regulate choice of quarters, rates of lodging money, servants, fuel and light, or allowances in their stead, detention and prize money, as well as allowances granted on account of wounds or injuries received in action, and pensions and allowances to widows and families.

5. Forage shall be granted to officers of the army medical department for such number of horses as are necessarily kept by them for duty.

6. Admission to the army medical department shall be by public competition.

7. Every candidate for appointment to the army medical department shall possess two diplomas or licences, one to practise medicine and the other surgery in Great Britain or Ireland, and be registered under the Medical Act in force at the time of his appointment.

8. A successful candidate, who, having passed through a course of instruction at the Army Medical School at Netley, in military medicine, surgery, hygiène, and pathology, shall have proved, after examination, that he possesses a competent knowledge of those subjects, shall receive a commission as surgeon for a limited period of 10 years' service on full pay. From the date of joining at Netley and up to that of passing his final examination, a candidate shall receive 5s. a day.

9. On the completion of 10 years' commissioned service, unless the surgeon be specially selected for further employment in the medical department of our army, or, if he be unwilling to continue to serve therein, his services shall be dispensed with, and he shall be entitled to receive in lieu of all pension or retirement, pension for wounds excepted, the sum of £1000.

10. A surgeon of less than 10 years' service, disqualified for duty by ill-health, certified by a board of medical officers to have been contracted in and by the service, may, at the discretion of our Secretary of State for War, be granted half-pay at a rate not exceeding 8s. a day if he have served 5 years or more, or 6s. a day if he have served less than 5 years, for a period not exceeding 6 months at one time.

11. At the expiration of that period of 6 months, if the surgeon be able to resume his duties, he shall be entitled to complete his term of 10 years' service. If he be unable to resume duty, as certified by a board of medical officers, he shall be allowed, if he have not served 5 years, a further period of 6 months, without half-pay; at the expiration of which period, if still unable to resume duty, his services shall be dispensed with.

12. If the surgeon have served 5 years on full pay, and be unable to resume duty as certified by a board of

medical officers, his services shall be dispensed with, and he shall be entitled to receive in lieu of all further pension or pay, pension for wounds excepted, a gratuity at one of the following rates, viz.:—

| | | | | |
|---|---|---|---|---|
| If he shall have completed | 9 | years' | full-pay service .. | £800 |
| ” ” | 8 | ” | ” .. .. | £700 |
| ” ” | 7 | ” | ” .. .. | £600 |
| ” ” | 6 | ” | ” .. .. | £500 |
| ” ” | 5 | ” | ” .. .. | £400 |

13. If a surgeon be unable to complete his 10 years' service from any cause other than wounds or ill-health, certified by a board of medical officers to have been caused in and by the service, or reduction of establishment, he shall be allowed not more than 6 months' leave without pay, after which, if unable to resume duty, his services shall be at once dispensed with, and he shall have no further claim on the department.

14. If the services of an officer be temporarily dispensed with in consequence of a reduction of establishment, he shall be granted the rates of half-pay fixed by article 10 until there be an opportunity of re-employing him, or, if he have served 5 years, he may retire from the service with a gratuity according to the rates specified in article 12.

15. Every year it shall be competent for our commander-in-chief, on the recommendation of the director-general of the army medical department, to select, with the approval of our secretary of state, a number of surgeons not exceeding six, who shall be retained in the service, and shall be promoted after 12 years' service on full pay to the rank of surgeon-major.

16. All promotion from the rank of surgeon-major to that of deputy surgeon-general, and from the rank of deputy surgeon-general to that of surgeon-general, shall be given for ability and merit upon the selection of our commander-in-chief, with the approval of our secretary of state; and the grounds of such selection shall be stated to us in writing, and recorded in the department. In all such cases the amount of foreign service shall be expressly stated.

17. A medical officer retiring after full-pay service of 25 years and upwards may, if recommended for the same by the head of his department, receive a step of honorary rank, but without any consequent increase of half-pay.

18. Good-service pensions shall be awarded to the most meritorious officers of the army medical department, under such regulations as shall be from time to time determined by us, with the advice of our secretary of state.

19. Six of the most meritorious officers of the army medical department shall be named our honorary physicians, and six our honorary surgeons.

20. Medical officers shall have a right to retire on half-pay after 20 years' service. Medical officers of the rank of surgeon-major or surgeon shall be placed on the retired list at the age of 55, and all surgeons-general and deputy surgeons-general at the age of 60 years.

21. Our secretary of state may, when he shall deem it fit, employ medical officers on the half-pay list in special situations at such rates of pay, in addition to half-pay, as he shall from time to time determine; but such officers shall vacate their appointments on attaining the age of 65 years.

22. A medical officer who, having voluntarily resigned his commission, has subsequently been permitted to re-enter the department shall not, except under very special circumstances, to be approved by our secretary of state, be allowed to reckon his former service.

*Service on the West Coast of Africa.*

23. Service of medical officers upon the west coast of Africa shall be voluntary.

24. Each year or portion of a year shall be allowed to reckon double towards retirement or towards the gratuities fixed by articles 9 and 12, but not towards increased pay, provided that the officer

shall serve at least 12 months on the west coast of Africa.

25. For each year's service on the coast, a medical officer shall be entitled to a year's leave at home, and for every additional period beyond a year he shall have an equivalent extension of leave.

26. Officers who may volunteer for service on the west coast of Africa shall receive double pay while actually serving on the coast.

*Non-effective Pay.*

27. A medical officer of more than 10 years' service placed on half-pay by reduction of establishment, or, on the report of a medical board, in consequence of wounds or ill-health caused in and by the discharge of his duties, or on account of age (under article 20), shall be entitled to half-pay in accordance with the following scale:—

| | | £ | s. | d. |
|---|---|---|---|---|
| Surgeon-general, after 30 years' service .. .. | Daily | 1 | 17 | 6 |
| „ „ 25 „ .. .. | „ | 1 | 13 | 6 |
| „ „ 20 „ .. .. | „ | 1 | 10 | 0 |
| Deputy surgeon-general, after 30 years' service .. | „ | 1 | 5 | 6 |
| „ „ „ 25 „ .. | „ | 1 | 2 | 6 |
| „ „ „ 20 „ .. | „ | 1 | 1 | 0 |
| Surgeon-major, after 25 years' service .. .. | „ | 1 | 0 | 0 |
| „ „ 20 „ .. .. | „ | 0 | 16 | 6 |
| „ „ 15 „ .. .. | „ | 0 | 13 | 6 |
| „ „ 12 „ .. .. | „ | 0 | 11 | 0 |
| Surgeon, after 10 years' service .. .. .. | „ | 0 | 10 | 0 |

28. The rate of half-pay awarded to officers retiring for their own convenience, after 20 years' service on full pay, under article 20, shall not exceed one-half of their full pay at the time of retirement.

29. Every medical officer who shall retire after a service upon full pay of 25 years shall be granted a rate of half-pay equal to seven-tenths of the daily pay he may have been in receipt of when thus retiring on half-pay, provided he shall have served 3 years in his rank, or shall have served abroad for 10 years in all ranks, or for 5 years with an army in the field. An officer of 25 years' full-pay service, whose service falls within neither of these conditions, shall be entitled to only seven-tenths of the daily pay he was in receipt of prior to his last promotion.

30. A medical officer of 20 years' full-pay service, placed temporarily on half-pay on account of ill-health, may, however, be allowed to retire on permanent half-pay, at the rates fixed by article 27, if after one year on half-pay he shall be reported by a medical board to be permanently unfit for further service.

31. In all matters not specially provided for in our present warrant, the officers of the medical department of our army shall be subject to the general regulations for the departments of our army.

**Medium Cavalry** — An appellation given to some of the regiments of the British army which are neither *heavy* nor *light*. There are 11 regiments of medium cavalry, 5 of which are lancers (5th, 9th, 12th, 16th, and 17th), 5 dragoon guards (1st, 2nd, 3rd, 6th, 7th), and one (6th) dragoons. The latter 6 regiments wear brass helmets. The average weight carried by the horses of the medium cavalry is about 18 stone 10 lbs.

**Metallic Cartridge**—A cartridge for breech-loading rifles, composed of a cylindrical case, made of metal, containing the bullet, the charge, and the percussion cap.

Metallic cartridges have been adopted as possessing better qualities than the so-called "self-consuming" cartridges. They are less liable to damp, as the mechanical fastening is sufficiently perfect to prevent the penetration of air and water. Miss-fires are almost unknown, because the cartridge, resting by means of a pad on the hinder part of the barrel, always presents the same resistance to the action of the piston when it crushes the priming.

The metallic cartridge presents another great advantage; it alone secures a complete closing of the breech, as the gases in escaping find no other issue but by the barrel. It keeps, besides, all dirt in the case, and consequently the chamber is always clean, and the grease, secluded from the contact of the air, does not get decomposed.

One of the disadvantages of this cartridge is its weight; 40 rounds of the Martini-Henry cartridge weigh 4 lbs. 6 oz. The adoption of a cartridge of this nature in France for the Gras rifle, in lieu of the "self-consuming" one of the Chassepôt, will increase the number of S.A.A. wagons by 200 for every 120,000 men.

The metal used for the manufacture of metallic cartridges is either red or yellow copper, brass tinsel, covered with cartboard, or, like that used for the Werndl rifle, tombac.

Red copper is generally used, as it is sufficiently elastic and tenacious by itself to expand under the action of the powder gas to cling to the sides of the chamber without splitting; if anything, it has a tendency rather to resume its first shape after exploding. Yellow copper is more brittle, stiffer, and less malleable, but of easier manufacture. Brass has been adopted for the cartridge of the Martini-Henry rifle. Cartridges made of this alloy, although more solid than the "self-consuming" cartridges, and less liable to spilting, to dirt, and to miss fire, are more expensive, because they must be made by hand, and each round fired is a cartridge case lost, whilst copper cases are again available.

**Musketry Drill**—The following are the new musketry drill instructions, issued with a view to improving the system of training and developing the shooting powers of the soldier with the Martini-Henry rifle:—

"The targets for individual practice are to have circular bull's-eyes and centres, and the number of points to be obtained with the Martini-Henry are 40 in each class. With the Snider, the points will be 40 in the first period, 30 in the second, and 25 in the third, to qualify for marksmen. Recruits will *not in future* perform position drill in *marching* order or with fixed bayonets. Ricochet butts are to be abolished, as a ricochet can be distinguished in the marker's butt by the sound and by the mark on the target, and the marker will be held responsible for the proper signalling. The direction of misses may be shown by special signal, but the marker must not leave his butt for the purpose. The use of dummy targets to indicate the exact position of hits is sanctioned. In consequence of the flat trajectory of the new service arm, judging distance practice will commence at 200 yards, and prizes will be issued for judging distance independent of the prizes for good shooting."

## N.

**Nip, To**—To stop ropes with a gasket, or with several turns of spun yarn round each, and the ends made fast.

## O.

**Overhaul, To**—A term used in artillery appliances in "overhauling" a tackle, that is, in separating the blocks. This should invariably be done from the standing, and not from the movable block.

## P.

**Parcel, To**—In the artillery service, as applied to a rope, is to put round it canvas well daubed with tar and bound with spun yarn to protect it from chafing.

**Pedestals**—Props made of wood, and used for the support of stool beds of carriages when the elevating screws are removed.

**Pension** — Under this head, in the body of the book, it has been omitted to state that, in the pensions awarded to officers after certain fixed periods, furlough, according to the regulations, is included in the length of service to be performed by an officer to entitle him to a pension. Thus, an officer, after 22 years' service, who is permitted under the regulations of 1776 to retire either as a captain or whatever his rank may be, can count 2 years of the above period, which he may have taken on furlough, as service towards his pension to complete 22 years.

Captains and majors, under the regulations of 1835–37, must have served 20 and 24 years respectively to entitle them to pensions, but in this period they may take 2 years' furlough counting as service towards their pensions. Likewise a lieutenant-colonel, in his service of 28 years, may take out of this 3 years' furlough counting as service towards pension, and a colonel 4 years in 32 years' service.

The scale of service for medical and veterinary surgeons is as follows:—

| Years. | Months. | | |
|---|---|---|---|
| 1 | 8 | in 17 and under 20 | years' service. |
| 2 | — | „ 20 „ 25 | |
| 3 | — | „ 25 „ 30 | |
| 4 | — | „ 30 years and upwards. | |

**Piasaba Brushes**—Gun brushes for field M.L.R. guns. There are two marks laid down in the 'Changes of War Matériel.' *Mark I.* consists of an elm head with piasaba grass glued into it, fixed upon a stave; the head is cylindrical, and the same length as a sponge-head. *Mark II.* is similar, except that it is stronger, and has the tufts of grass running spirally instead of longitudinally.

**Pipe-box**—This nature of box, which is inserted in the nave of a gun carriage wheel, is shown in the body of the book to be made of an alloy known as " metal." Recent orders direct it, in the 9-pr. and 16-pr. M.L.R. guns, to be made of phosphor-bronze.

**Place d'Armes** (French)—Any fortified town, or part of it, which forms a place of rendezvous for troops, &c.

**Preventer**—An additional rope, employed, when necessary, to support or answer the purpose of another when injured or subjected to too great a strain.

**Prize for Shooting**—A reward given annually by government to the best marksmen in regiments. Hitherto the reward has been confined to the best shots with small-arms, but an order has lately been issued by the Secretary of State for War, granting an annual prize competition in the regiment of royal artillery. The provisions of this award will be found in the army circular dated June 1, 1876, par. 74.

## R.

**Ranker**—A non-commissioned officer who rises to be a commissioned officer.

**Raw Hides**—Hides not tanned. They are used to cover the revetments of embrasures in fieldworks. The hides are doubled, the hair inwards, two to each cheek of the embrasure, and fixed by pickets driven through them.

**Rising from the Ranks**—To pass through the successive stages in the ranks until a non-commissioned officer attains the rank of a commissioned officer. Each non-commissioned officer rising from the ranks receives, on getting his commission, a grant of £150 in the cavalry, and of £100 in the infantry, to enable him to purchase his outfit.

## S.

**Sanitary** — Having reference to measures for securing health.

Within the last twenty years, increased means have been adopted to reduce the state of mortality amongst the soldiery both at home and abroad. During the Crimean War, the casualties were large at first, but from sanitary measures being taken, the number of deaths per 1000 men was greatly reduced. In this country, up to 1853, the mortality per 1000 amongst the soldiery was 17·5, whereas that of the male population of England amounted to 19·2. The great mortality was in those days amongst the foot guards, and appears to have arisen in a great measure from want of proper sanitary arrangements. But a great improvement of late years has taken place in the health of the soldier; his barracks are better ventilated, his comforts and amusements are greater, and indeed all the measures adopted to keep him in health are more numerous than they formerly were:

In 1874 the strength of the army in Great Britain was about 90,000; the average rate of mortality during that year was 8⅖ per 1000; this was a higher death rate than in 1873, which is accounted for in the higher death rate among the general population in 1874.

The report from which the above information is gained observes that "no doubt the rate of admission and death in 1874 was also somewhat raised by the circumstance that many invalids from abroad, instead of being sent to Netley, joined their depots, and the records of their admission and deaths were not always kept distinct from those of the other soldiers."

**Self-consuming Cartridge**—The original cartridge of the needle-gun and of the Chassepôt; it is made of a linen or silk envelope, and the explosive composition placed in the centre of the powder. Experience has shown that no cartridge can be trusted to consume entirely in the barrel, under all circumstances, as the metal conveys the heat away so rapidly that often the thin paper in contact with it is untouched from the combustion of the powder. This cartridge therefore leaves in the chamber a mass of *débris*, paper, caoutchouc, copper, and dirt. In order to counteract this, the chamber has to be made a little larger than is necessary; hence, frequent miss-fires. The grease with which the cartridge is covered gets decomposed, and remains useless, if it does not penetrate through the paper and attack the powder, so that after twenty rounds the dirt in the rifle is solidified, accuracy is lost, and firing is stopped from the impossibility of loading. The cartridge is besides very liable to get damp, on account of the paste it contains, and it is quickly damaged in magazines.

The Chassepôt (as modified by Major Gras) and the German needle-gun (Mauser) now fire a metallic cartridge.

**Short Service**—A period of 6 years, and not less than 3, which soldiers must serve under the colours. (*Vide* Appendix I.)

By a recent order from the Horse Guards, recruits enlisting for short service into all regiments but cavalry may do so up to the age of 30.

## T.

**Torpedo**—The following is a description of Professor Abel's *mechanical torpedo*, or *exploder*, which is an improvement on the torpedo mentioned in the body of the book. It is composed of a plain leaden tube, with one of its ends open, containing chlorate of potash and sugar in equal parts; this tube contains one made of thin glass filled with pure sulphuric acid; the whole is then corked up. The leaden tube is surrounded by, but not in contact with, another india-rubber tube, and over this again are placed two brass tubes, one passing at the top of the apparatus and the other under the bottom, in such a manner that, when struck, they prevent the leaden tube from bending anywhere but in the centre. To make this comparatively safe when laying down, there are three iron guards, forming another tube around the aperture of the apparatus; these are kept there by means of a cap on the top of the exploder, and a small slot round the upper part of the screw, at the bottom, so that, when the mine is laid, the cap can be removed by a rope's end, and the guards fall off.

When struck, the india-rubber and the leaden tube holding the composition bend, and by so doing break the glass tube; the sulphuric acid mixes with the chlorate of potash and sugar, thus causing ignition. The case containing the explosive matter is a thin iron cask, moored about 10 feet below the surface of the water.

This torpedo exploder is screwed into the mine.

**Trooping the Colours** — A ceremony performed by troops assembled on parade for guard-mounting. The 'Field Exercise and Evolutions of Infantry,' of 1874, gives detailed instructions as to the mode to be pursued in trooping the colours.

The origin of the ceremony does not appear to be clearly known. In a recent number of *The World* it is surmised that the trooping of the colours comes to us from the Germans, and is symbolical of their ceremonious reception by a force on taking the field, and that the marching of them along the face of the parade is to remind every individual soldier of the duty he owes to his colours, and to demand from him the tacit pledge to fulfil that patriotic duty. Another explanation is given in the same paper that the ceremony is significant of the formal housing of the colours after having been in the field; and Grose, on 'Military Antiquities,' is cited to the following effect:—

"The captain leading them (his troops with the colours) out of the field, and coming near to the place intended to lodge his colours, converts the ranks of musqueteers of both divisions to the right and left outwards and joins them; and being so fixed, the body of pikes stand in the rear and the ensign at the head of them, the captain before the colours with the drum, and sergeants guarding the colours on each side, and the lieutenant behind the standard-bearer; and all being advanced shall troop up with the colours folded to his lodgings or quarters; and as he approacheth thereto, he shall, with a bow to his captain, carry in his colours; then the word shall be given to all the musqueteers to make ready; that being done, they shall all present, and upon the beat of the drum, or other word of command, give one entire volley."

In this may be traced the rudimentary idea of the present elaborate ceremony of trooping.

## V.

**Veterinary Department**—One of the civil departments of the army. This department is composed of a principal veterinary surgeon, staff veterinary surgeons, veterinary surgeons of the 1st class, and veterinary surgeons. There are also veterinary surgeons on probation.

The principal veterinary surgeon, who is stationed at Woolwich, is the sole administrative head of the department. He superintends and directs the professional and departmental duties of the veterinary surgeons of the army as circumstances may require; he exercises general control over all stores of the department. In addition to enforcing obedience to regulations, he issues such instructions as may seem necessary to meet specialities. Candidates for the veterinary department have to pass an examination before a board of military veterinary surgeons; if qualified, the successful candidates are admitted on probation. After 5 years' service they must pass an examination to be eligible for promotion to the rank of veterinary of the 1st class, and after 15 years' full-pay service in that rank they are eligible for promotion to that of staff veterinary surgeon.

The senior staff veterinary surgeon, at a station, is responsible to the principal veterinary surgeon that the duties of the officers under his control are properly carried out. All returns and reports are sent to the staff veterinary surgeon, who again renders the necessary returns, &c. to the principal veterinary surgeon.

Veterinary surgeons are permitted to retire on half-pay after 25 years' service. Veterinary surgeons and surgeons of the 1st class are placed on the retired list on attaining the age of 55 years, and staff veterinary surgeons when they have attained the age of 65 years. (*Vide* Appendix O.)

# APPENDICES.

## APPENDIX A.

### I.—REGULATIONS FOR THE GOVERNMENT OF THE ROYAL MILITARY ACADEMY, WOOLWICH.

#### OBJECT OF THE ROYAL MILITARY ACADEMY.

1. The Royal Military Academy is maintained for the purpose of affording a preparatory education to candidates for the royal artillery and royal engineers; this education will be chiefly technical, and will in no obligatory subject be carried beyond the point useful to both corps alike.

#### REGULATIONS FOR ADMISSION, &C.

2. Admission to the Royal Military Academy as cadets will be granted to the successful candidates at an open competitive examination. The examinations will be conducted by the Civil Service Commissioners, and will be held twice a year, namely in December and July.

3. Notice will be given from time to time of the day and place of the examinations, and of the vacancies to be competed for at each examination.

4. The limits of age will be from sixteen to eighteen, the candidates being required to be within those limits on the 1st day of the January next following for the winter examination, and on the 1st of July for the summer examination.

5. Candidates for admission to the December or July examination must send to the military secretary, not less than one month before the 1st December or 1st July respectively, an application to be examined, accompanied by the following papers:—(*a*) An extract from the register of his birth, or, in default, a declaration made by one of his parents or guardians before a magistrate, giving his exact age. (*b*) A certificate of good moral character, signed by a clergyman of the parish in which he has recently resided, or by the tutor or head of the school or college at which he has received his education for at least the two preceding years, or some other satisfactory proof of good moral character.

6. When a candidate who has once been examined applies to be examined again, he will only be required to forward a certificate as to his moral character for the interval between the two examinations.

7. The number of trials allowed will not exceed three.

8. All candidates will be inspected by a medical board; and no candidate will be allowed to proceed to examination by the Civil Service Commissioners unless certified by the board to be free from bodily defects or ailments, and in all respects,

as to height and physical qualities, fit for her Majesty's service. Cases of exceptional shortness of stature will be referred to the War Office for special consideration.

9. A candidate will be required to satisfy the Civil Service Commissioners in the following subjects:—(1) Mathematics, viz. (*a*) arithmetic, and the use of common logarithms; (*b*) algebra, including equations, progressions, permutations and combinations, and the binomial theorem; (*c*) geometry, up to the standard of the sixth book of Euclid; (*d*) plane trigonometry, including the solution of triangles. (2) French, German, or some other modern language, the examination being limited to translation from the language and grammatical questions. (3) Writing English correctly and in a good legible hand, from dictation, and English composition. (4) The elements of geometrical drawing, including the construction of plane scales and the use of simple mathematical instruments. (5) Geography. A thorough knowledge of each of the four branches of mathematics will be required. The commissioners may, however, if they think fit, dispense with this preliminary examination, except as regards mathematics, English composition, and geometrical drawing, in the case of any candidate who has satisfied them on a previous occasion.

10. No marks will be allotted for the above preliminary examination excepting for mathematics (2000), for English composition (500), and for geometrical drawing (300).

11. The "further examination" will be proceeded with immediately on the conclusion of the "preliminary examination." Candidates who fail in the preliminary examination will be informed of their failure as soon as possible, and they will then be released from further attendance.

12. The subjects of the further examination and the maximum number of marks obtainable for each subject will be as follows:—

| | | Marks. |
|---|---|---|
| (1) | Mathematics,* viz. further questions and problems on the subjects of the qualifying examination, and the elements of the following subjects: theory of equations; analytical geometry; conic sections; solid geometry; differential and integral calculus; statics; and dynamics .. .. .. .. .. .. | 4000 |
| (2) | English: English literature, limited to specified authors; and English history, limited to certain fixed periods; the authors and periods being notified beforehand .. .. .. .. | †2000 |
| ‡(3) | Classics, viz. Latin .. .. .. .. .. .. | 2000 |
| | Greek .. .. .. .. .. .. | 2000 |
| (4) | French, the examination to be partly colloquial .. .. .. | 2000 |
| (5) | German, the examination to be partly colloquial .. .. .. | 2000 |
| (6) | Any one of the following languages at the option of the candidate, viz. Italian, Russian, Spanish, or Hindostanee; the examination to be partly colloquial .. .. .. .. .. | 2000 |
| §(7) | Experimental sciences, viz. (*a*) chemistry and heat; or (*b*) electricity and magnetism .. .. .. .. .. .. | 2000 |
| (8) | General and physical geography and geology .. .. .. | 2000 |
| (9) | Drawing, free-hand .. .. .. .. .. .. .. | 1000 |

Of these nine subjects, candidates will not be allowed to take up more than four, exclusive of drawing. N.B.—In all the subjects, great importance will be attached to accuracy in numerical results.

13. A certain number will be deducted from the marks gained by a candidate

---

* See Detailed Syllabus, par. 14.

† Including 500 allotted to English composition in the preliminary examination.

‡ Classics are divided into two sections, Latin and Greek, either or both of which the candidate may take up as one subject.

§ Subjects (*a*) and (*b*) are alternative; a candidate will not be allowed to take up both.

in each subject, except mathematics; and the remainders will be added to the marks gained by the candidate in the preliminary examination in mathematics, English composition, and geometrical drawing The resulting total will determine the candidate's place in the competitive list; the successful candidates being those who stand first on the list up to the number of vacancies competed for.

### OPTIONAL EXAMINATION IN MATHEMATICS.—DETAILED SYLLABUS.

14. Further questions and problems on the subjects of the qualifying examination. Theory of equations: first principles. Analytical geometry: problems on straight line and circle. Conic sections: elementary properties, with easy problems, both on the analytical and geometrical methods. Solid geometry: first principles, with easy exercises. Differential calculus. Differentiation of functions of one independent variable. Taylor's and Maclaurin's theorems; applications. Maxima and minima of functions of one independent variable. Method of infinitesimals: first principles, with easy applications. Tangents and normals to curves. Points of inflexion. Curvature of curves. Involutes and evolutes. Integral calculus. Elementary integrations. Integration considered as summation. Rectification and quadrature of plane curves. Statics: equilibrium of forces and couples in one plane. Friction: centre of gravity; mechanical powers. Problems on elementary statics: the graphical or geometrical method of treating such problems should be studied as well as the analytical. No applications of the differential calculus to statics will be required. Dynamics: elementary principles; projectiles; motion of a heavy particle on a smooth curve; centrifugal force; simple pendulum. Problems and exercises. No applications of the differential calculus will be required.

### TERMS OF PAYMENT.

15. The terms of payment for cadets at the Royal Military Academy are regulated by the following articles of her Majesty's warrant of the 27th December 1870 for the pay and promotion of the army:—

*Payment for cadet.*—The payment to be contributed on behalf of a cadet shall be as follows, and shall be paid half-yearly in advance:—

| | Annually. £ |
|---|---|
| Queen's cadets (if any) .. .. .. .. .. .. .. .. | *Nil.* |
| For the son of an officer of the army or navy who has died in the service, and whose family is left in pecuniary distress (subject to the approval of our secretary of state) .. .. .. .. .. .. .. | 20 |
| For the son of an officer below the rank of colonel or regimental field officer in the army, and captain or commander in the navy, or of an instructor at the Royal Military Academy, or Royal Military College, or Staff College .. | 40 |
| For the son of a colonel or regimental field officer in the army, or of a captain or commander in the navy, or of a professor at the Royal Military Academy, or Royal Military College, or Staff College .. .. .. | 60 |
| For the son of a general officer who is not colonel of a regiment, or of a vice- or rear-admiral .. .. .. .. .. .. .. .. .. | 70 |
| For the son of an admiral or of a general officer who is colonel of a regiment or in receipt of Indian colonel's allowances .. .. .. .. .. | 80 |
| For the son of a private gentleman .. .. .. .. .. .. | 125 |

*Scale of payment, how computed.*—In determining the rate of payment—

*a.* A general officer on the half-pay of his last regimental commission shall pay in accordance with such regimental rank.

*b.* Officers who have sold their commissions shall be regarded as private gentlemen.

*c.* Officers on retired full or half-pay after 25 years' service, or officers of less than 25 years' service, if placed on half-pay by reduction of establishment, or on account of ill-health, shall pay in accordance with their last substantive regimental rank. The cases of officers voluntarily retiring to half-pay before completing 25 years' service shall be specially considered.

*d.* Officers of the departments of the army and navy according to their relative rank, of the permanent staff of the militia, adjutants of the volunteer force, as well as Indian military and naval officers, shall be treated on the same terms as military or naval officers.

*e.* The sons of deceased officers shall be contributed for in accordance with the foregoing regulations in regard to the rank or classification of their fathers.

*Sickness and rustication.*—If a cadet be absent a whole term in consequence of sickness or rustication, a payment of £10 shall be required for the privilege of his name being kept on the rolls of the establishment, and for a vacancy being guaranteed at the commencement of the next term.

*Orphans.*—In the case of a cadet who is an orphan, whose annual contribution is only £20, the amount to be paid when absence extends over a whole term shall be determined by the secretary of state.

*Sickness.*—If a cadet be absent from sickness during a portion of the term, his pay shall continue to be issued and credited to his account, but no refund of the contribution shall be permitted.

*Rustication.*—If a cadet be rusticated or removed during a term, his daily pay shall cease from the date on which he is sent away, and the contribution made for the half-year shall be forfeited.

*Pay of cadet.*—The pay of a cadet shall be 3s. a day. It is issued to cover the expenses of regimental clothing, messing, washing, and other contingencies. All other necessary expenses of this nature, as well as weekly pocket money, postage of letters, bootmakers' and tailors' bills for repairs, &c., which cannot be covered by his pay, shall be chargeable to his parent or guardian in addition to the regulated contribution.

*Extra payments for cadets.*—Each cadet on first joining shall be required to pay, in addition to the regulated contribution, a sum of £25 to cover the expenses of uniform, books, &c., and to bring with him the articles of clothing of which he will receive notice, and which must afterwards be kept up at his own expense. He shall also be required to pay the regulated contribution in advance, for each half-year of the time during which he remains under instruction, and a deposit of £5 on account, for contingent expenses, which latter sum he shall be required to make up on returning to the Royal Military Academy after each vacation, to cover any expense that may be incurred on his account during the ensuing half-year.

## GOVERNMENT AND ORGANISATION.

16. The Field Marshal Commanding-in-Chief will be the president of the Royal Military Academy.

17. An independent inspection by a board of visitors, appointed by the Secretary of State for War, and reporting to him, will be made once a year. Such visitors will not be a permanent body, but will not be all changed at the same time. The report of this board will be presented to parliament.

18. The academy will be under the control of a governor, a military man, selected with special reference to his qualifications for superintending both instruction and discipline, and appointed by and responsible to the Secretary of State for War, through the Field Marshal Commanding-in-Chief.

19. The governor, by virtue of his office, will have local rank superior to that of any of the officers employed under him.

20. The tenure of the appointment is regulated by the following article of the royal warrant of the 27th December 1870:—The appointment of governor of

the Royal Military Academy . . . . shall be for seven years, with power of re-appointment; but shall in all cases terminate after fourteen years, or at the age of sixty.

21. The governor, with the approval of the Secretary of State for War, will have the power of appointing and removing the professors and instructors.

22. The organisation will be on a military basis.

23. The governor will be solely responsible for discipline and for the general superintendence of the studies.

24. He will be assisted in the arrangement of the studies by the academy board, composed of the professors or senior instructors of the different branches. The head of each branch will have the general power of supervision and inspection over the studies of his department, with the duty of reporting on them to the governor.

25. The governor will from time to time assemble and confer with all the professors and instructors of each separate branch on matters relating to it.

26. The governor will be assisted by a staff officer, not under the rank of captain, who will be secretary and treasurer, and have charge of the records, correspondence and accounts of the establishment, and make all local payments connected therewith, and receive the contributions for the cadets. This appointment will be for seven years, with power of re-appointment.

27. The cadets will form one company under a captain, assisted by four lieutenants, charged with the discipline out of studies and the drill, one of whom will be adjutant and quartermaster.

28. The professors and instructors may be either military men or civilians.

29. The professors and instructors will have certain limited powers of punishment, within and without the halls of study, at the discretion of the governor, to whom they will report all punishments which they may inflict.

30. The chaplain will be specially appointed by the Secretary of State, and will give instruction in classics.

31. The tenure of office of the professors and instructors is regulated by the following article of the royal warrant of 27th December 1870:—The professors and instructors at our Royal Military Academy shall be appointed for six years, with power of re-appointment. Their term of office shall not continue after the age of fifty-five, unless an extension be specially recommended by the governor and approved by our Secretary of State.

32. No professor or instructor will be permitted to give private instruction to a cadet, either during the vacation or at any other time, or be allowed to prepare candidates for admission to the academy.

33. The governor will have the absolute power of rustication and removal, and also of sentencing a cadet for misconduct to lose places in the list of successful candidates for commissions; when expulsion is necessary, the case will be referred to the Secretary of State through the Field Marshal Commanding-in-Chief.

34. The name of any cadet expelled for misconduct will be recorded in the office of the Field Marshal Commanding-in-Chief, and will be made known to the First Lord of the Admiralty, and to the Secretary of State for India, in order to prevent his being admitted into her Majesty's naval, military, or Indian service.

35. A sword will be given at each final examination as a special reward for excellence in conduct.

36. The governor will cause registers to be kept of all serious punishments awarded, and of the offences which have caused them.

37. He will inspect accounts of every description connected with the academy, and certify those which require it.

## Course of Instruction.

38. The length of the course of instruction will be two years and a half.

39. If any cadet fail to come up to the required standard at two examinations, or be found unable to qualify in his studies for a commission within three years, to be counted from the commencement of the term in which he first joins, or to acquire a sufficient proficiency in military exercises, he will be removed. No extension of the above period of three years will be granted on account of absence from any cause excepting illness. Cases of protracted absence on account of illness will be specially referred for decision to the Secretary of State for War through the Field Marshal Commanding-in-Chief.

40. The following subjects will form the course of obligatory studies:—(1) Mathematics, including a thorough knowledge of plane trigonometry; practical mechanics, with the application of mathematics to machinery. (2) Fortification, field and permanent; such a course as is suitable to cadets qualifying for the artillery, and the requisite amount of geometrical drawing. (3) Artillery; such a course as is suitable to cadets qualifying for the engineers. (4) Military drawing, with field sketching and reconnaissance. (5) Military history and geography. (6) French or German, at the student's choice. (7) Elementary chemistry and physics. (8) Drills and exercises.

41. In addition to the obligatory course, every cadet will be allowed, at his option, to take up certain voluntary subjects, viz.:—(1) Higher mathematics. (2) Higher portions of fortification. (3) Any of the following languages:—German or French, Italian, Russian, Spanish, or Hindostanee. (4) Freehand, figure, and landscape drawing. (5) Higher chemistry. (6) Latin and (7) Greek; instruction in these subjects to be given by the chaplain.

42. Marks will be assigned to the obligatory subjects of instruction in the following proportions:—Mathematics and mechanics, 7; fortification, 7; artillery, 5; military drawing and reconnaissance, 6; military history, &c., 3; one modern language, French or German, 2; elementary chemistry and physics, 2; drills and exercises—manual, platoon, and company drill, ½; gymnastics, ½; riding and sword exercises, ½; artillery, 2; total 3½.

43. The voluntary subjects shall be valued as follows:—Higher mathematics, 5; higher fortification, 3; Latin, 2; Greek, 2; any of the following languages—French or German, Italian, Russian, Spanish, or Hindostanee, 2; freehand, figure, and landscape drawing, 2; higher chemistry, 2.

44. No obligatory subject shall gain a cadet any marks unless he obtain a minimum of one-half marks in it.

45. No cadet will be ensured a commission unless he qualify by obtaining at least one-half marks in the obligatory course in mathematics and mechanics, fortification, and artillery, and one-half of the total aggregate of the marks allotted to all the obligatory subjects.

46. No voluntary subject shall gain a cadet any marks unless he obtain a minimum of at least one-third of the marks assigned to that portion of it in which he is examined. The marks gained in the voluntary subjects will be added to those obtained in the obligatory subjects to make a second total, according to which cadets shall be finally placed.

47. The periodical examinations will be entirely conducted by examiners independent of the academy, the whole of the marks except those reserved for notebooks and drawing being allotted according to their results.

## Staff of the Establishment.

48. The following will be the staff of the establishment:—Governor, secretary and treasurer, captain commanding company, 3 lieutenants, adjutant and quartermaster, medical officer, chaplain, 4 professors and instructors of mathematics and

mechanics, 4 professors and instructors of fortification and geometrical drawing, 2 professors and instructors of artillery, 4 professors and instructors of military drawing, &c., and professor and instructor of military history and geography, 2 professors and instructors of French and German, 1 professor and instructor of figure and landscape drawing, and 1 professor and instructor of chemistry.

49. The pay and allowances of the officers are regulated by the following articles of her Majesty's warrant of the 27th December 1870:—The pay of the officers of our Royal Military Academy shall be as follows:—

Governor, £1500 yearly, inclusive of all allowances except quarters, and in addition to his unattached pay as a general officer or his pay as colonel commandant of royal artillery or royal engineers, in the event of his holding such rank; secretary and treasurer, not of lower rank than captain, £400 yearly, inclusive of all allowances except quarters, and in addition to regimental pay; captain of company, 12s. daily, and regimental pay (also forage allowance for one horse, quarters, fuel, and light, and 2 soldier servants); lieutenants, each 4s. daily, and regimental pay (also quarters, fuel, and light, and 1 soldier servant); adjutant and quartermaster, 5s. daily, and regimental pay as lieutenant (also quarters, fuel, and light, forage allowance for 1 horse, and 2 soldier servants); surgeon, according to his rank in the army medical department; chaplain and classical instructor, £400 yearly, and quarters, fuel, and light; professor of mathematics, if a civilian, £550 to £700 yearly, by a triennial increase of £50; professor of mathematics, if an officer, £550 yearly, without increase; instructors of mathematics, if civilians, £350 to £500 each yearly, by a triennial increase of £50; instructors of mathematics, if officers, £450 yearly, without increase; professor of fortification, £550 yearly; instructors of fortification and geometrical drawing, each, £450; professor of artillery, £550; instructors of artillery, £450; professor of military drawing, £550; instructors of military drawing, each, £450; professor of military history, £500; professor of French, £350; professor of German, £350; professor of landscape drawing, £350; professor of chemistry, £400.

The above scale of pay (and allowances) shall include all remuneration of every kind except any additional pay, beyond his ordinary regimental pay, to which an officer may be entitled by brevet rank or as a reward for distinguished service in the field, and no person hereafter to be appointed to any of the above appointments shall be entitled to pension or superannuation allowance for services in such appointment.

50. The appointments of military professors and instructors are open to officers of all ranks.

51. No person whatever belonging to the Royal Military Academy is to receive a present from any cadet, or from the relations or friends of any cadet.

52. Commissions as lieutenants in the royal artillery or royal engineers will be conferred upon candidates who qualify in accordance with pars. 39 to 45.

53. The commissions of such lieutenants as are recommended by the governor of the academy, and afterwards pass through their practical course at Woolwich and Chatham in a satisfactory manner, will be antedated 6 months.

## II.—REGULATIONS RESPECTING EXAMINATIONS FOR FIRST APPOINTMENTS TO THE ARMY.

### First Appointments to Cavalry and Infantry.

1. The examinations will be conducted by the Civil Service Commissioners, and will take place twice a year, in the months of December and July.

2. Notice will be given from time to time of the day and place of the examinations.

3. The number of trials allowed will not exceed three.

4. All candidates will be inspected by a medical board, and no candidate will be

allowed to proceed to examination by the Civil Service Commissioners unless certified by the board to be free from any bodily defects or ailments, and in all respects, as to height and physical qualities, fit for her Majesty's service. Cases of exceptional shortness of stature will be referred to the War Office for special consideration.

5. The limits of age for candidates for admission by competition, Queen's cadets, Queen's honorary cadets, Indian cadets, and pages of honour, will be from 17 to 20; for students of the universities who shall have passed the interim examination as specified in par. 24, from 17 to 21; for graduates of the universities who shall have passed the examination for the degree of B.A. or M.A., from 17 to 22; and for lieutenant from the militia, from 19 to 22. Officers who entered the militia between the 16th of February and the 1st of November 1871, inclusive, may be admitted up to the age of 23.

6. Candidates who desire to compete for commissions in West India regiments may be admitted up to the age of 24.

7. Candidates must be within the prescribed limits of age on the following date:—Candidates for admission by competition, Queen's cadets, Queen's honorary cadets, Indian cadets, and pages of honour, on the 1st of January next following the winter examination, and on the 1st of July for the Midsummer examination. Graduates and students from the universities, on the date of passing the university examination, as specified in par. 24. Lieutenants from the militia, on the 1st of May of the year in which they are recommended for a commission in the army.

8. Notice will be given, from time to time, of the number of sub-lieutenancies open to general competition at each periodical examination.

9. A candidate for admission by competition at the December or July examinations must send to the military secretary, not less than one month before the 1st of December or the 1st of July respectively, an application to be examined, accompanied by the following papers:—

(*a*) An extract from the register of birth; or, in default, a declaration made by one of his parents or guardians before a magistrate, giving his exact age.

(*b*) A certificate of good moral character, signed by a clergyman of the parish in which he has recently resided, or by the tutor or head of the school or college at which he has received his education, for at least the two preceding years, or some other satisfactory proof of good moral character.

10. A candidate who has once been examined will only be required, when he applies to be examined again, to forward a certificate of good moral character for the interval between the two examinations.

11. All candidates will be required to satisfy the Civil Service Commissioners in the following subjects:—

(1) Mathematics—viz. (*a*) arithmetic, including vulgar and decimal fractions, proportion, and simple interest; (*b*) geometry, not beyond the standards of the first book of Euclid.

(2) French, German, or some other modern language, the examination being limited to a translation from the language, and grammatical questions.

(3) Writing English correctly, and in a good legible hand, from dictation.

(4) The elements of geometrical drawing, including the construction of scales, and the use of simple mathematical questions.

(5) Geography.

12. No marks will be allotted for the above preliminary examination except for geometrical drawing, the maximum number for which will be 300.

The preliminary examination will be dispensed with in all other subjects in the case of candidates who have passed it at the previous examinations.

13. The further examination will be proceeded with immediately on the conclusion of the preliminary examination. Candidates who fail in the preliminary examination will be informed of their failure as soon as possible, and they will then be released from further attendance.

14. The subjects of the further examination and the maximum number of marks obtainable for each subject will be as follows:—

(1) Mathematics—viz. algebra, up to and including quadratic equations; the theory and use of logarithms, geometry, plane trigonometry, and mensuration—3000 marks.

(2) English composition, tested by the power of writing an essay, a letter, or *précis*; English literature, limited to specified authors; and English history, limited to certain fixed periods, the authors and periods being notified beforehand—3000 marks.

(3) Latin—3000 marks.

(4) Greek—3000 marks.

(5) French, the examination to be partly colloquial—2000 marks.

(6) German, the examination to be partly colloquial—2000 marks.

(7) Experimental sciences—viz.* (*a*) chemistry and heat, or (*b*) electricity and magnetism—2000 marks.

(8) General and physical geography and geology—2000 marks.

(9) Drawing, freehand—1000 marks.

Of these nine subjects, candidates will not be allowed to take up more than four, nor less than two, exclusive of drawing.

15. In order to secure a proper proficiency in all the subjects taken up by a candidate, a certain number will be deducted from the marks gained by the candidate in each subject.

16. The following will be the mode of selecting the successful candidates at the open competitive examination. After the proper deduction (in accordance with par. 15) has been made from the number of marks gained by each candidate in the several subjects in which he has been examined, the remainders will be summed up, and the marks gained by the candidate in geometrical drawing at the preliminary examination will be added thereto. The resulting total will determine the place of the candidate in the competition list, the successful candidates being those who stand at the head of the list up to the number of vacancies competed for.

17. Queen's cadets are sons of officers of the army, royal navy, and royal marines, who have fallen in action, or died of wounds received in action, or of disease contracted on service abroad, and who have left their families in reduced circumstances. They are appointed by the secretary of state on the recommendation of the Commander-in-Chief or the First Lord of the Admiralty.

18. Honorary Queen's cadets are sons of officers of the army, royal navy, and royal marines, who were killed in action, or who have died of wounds received in action within 6 months of such wounds having been received, or of illness brought on by fatigue, privation, or exposure incident to active operations in the field before an enemy, within 6 months after their having been first certified to be ill. (See art. 5 of the royal warrant of the 27th of November 1873, clause 151, Army Circulars, 1873.)

19. Applications for Queen's cadetships should be addressed to the military secretary if the candidate is the son of an officer of the army, or to the secretary of the Admiralty if the candidate is the son of an officer of the royal navy or royal marines.

20. Indian cadets are the sons of persons who have served in India in the military or civil service of her Majesty or of the East India Company, and are nominated by the Secretary of State for India in Council, under the provisions of 21 and 22 Vict. cap. 106, and 23 and 24 Vict. cap. 100. Applications for Indian cadetships should be addressed to the military secretary, India Office.

21. A Queen's cadet, honorary Queen's cadet, Indian cadet, or page of honour must send the papers mentioned in pars. 9 and 10 to the military secretary immediately on receiving any order from him so to do.

22. In accordance with art. 1 of the royal warrant of the 30th of October 1871, Queen's cadets, honorary Queen's cadets, Indian cadets, and pages of honour will be required to pass a qualifying entrance examination only—i.e. after having

---

* *Subjects (a) and (b) are alternative; a candidate will not be allowed to take up both.*

passed the preliminary examination under par. 11, to obtain under pars. 14 and 15 such an aggregate of marks as may indicate in the judgment of the Civil Service Commissioners a competent amount of general proficiency.

23. Candidates who can produce a university certificate, as prescribed in paragraph 24, will be exempted from the qualifying entrance examination described in the preceding paragraph.

24. A graduate or student of one of the universities hereinafter specified who is a candidate for the commission of sub-lieutenant must send an application to the military secretary not later than the 31st of May or the 31st of October next following the date of his university qualification, with a view to his appointment under the provisions of par. 25. The application must be accompanied by papers (*a*) and (*b*) described in par. 9, and by a certificate from the proper authority that he has taken his degree in arts, or has passed the university examination specified below:—

Oxford—Moderations.

Cambridge—The previous examination.

Dublin—The final examination of the senior freshman year.

Durham—The first year's examination.

Queen's University, Ireland—The first university examination in arts or in engineering.

Scotch universities.—The examination for candidates for the army.

London University—The first examination for the degrees of B.A., LL.B., B.Sc. or M.B.

25. Notice will be given, from time to time, of the number of vacancies which will be allotted half-yearly to university candidates. In case there should be more candidates than vacancies, the required number will be selected by competition among the said candidates at the ensuing July or December examination. The successful candidates must then be prepared to accept commissions in the course of the following 6 months, otherwise their claims will lapse.

26. Notice will be given, from time to time, to officers commanding militia regiments whenever they will be permitted to recommend a lieutenant for a commission in the army; probably one in each year for a battalion of 10 companies and for other battalions in proportion.

27. Before a lieutenant of militia can be granted a commission as a lieutenant in the army, he will be required (*a*) to have served two annual trainings with his militia regiment; (*b*) to pass the qualifying examination described in par. 22, or to produce a university certificate as prescribed in par. 24; (*c*) to produce a certificate from a board of examination that he is thoroughly acquainted with the following subjects*: — The first two parts of the field exercise of the infantry and the command of a company in battalion. Rifle drill and practice; and the theoretical principles of musketry as defined in the authorised book of instruction. The duty of regimental orderly officers, of officers commanding guards, and of subaltern officers of guards under officers of superior rank, and the mode of marching reliefs and posting sentries. Those parts of the Queen's Regulations and Orders for the Army which relate to the duties and conduct of a subaltern officer; and the Mutiny Act and Articles of War, so far as is necessary for the performance of the duties of a member of a court-martial. The regulations for the army in regard to the pay and messing of the troops, the supply of clothing and necessaries, and all details regarding the mode of carrying the various articles of the soldiers' kit, arms, accoutrements, and ammunition. (*d*) To be recommended by his commanding officer, the recommendation being confirmed by the officer commanding the subdistrict, and the general officer commanding the district.

28. Lieutenants of militia recommended under par. 26, who are within the

---

* When an officer has within two years obtained a certificate of qualification in drill from a school of instruction or from a board of officers, he will be examined only in such of the required subjects as he has not already passed in.

limits of age prescribed in par. 5, will be examined by the Civil Service Commissioners (par. 27), (*b*) in October of each year. Notification of such examination will be made by the military secretary. Candidates who fail in this examination will be allowed two other trials at the next ensuing examinations for first appointments.

## III.—REGULATIONS FOR THE GOVERNMENT OF THE ROYAL MILITARY COLLEGE AT SANDHURST.

1. The Royal Military College is maintained for the purpose of affording a special military education to sub-lieutenants of cavalry and infantry recently appointed, and to successful candidates in the competitive examinations for commissions.

2. The number of sub-lieutenants admitted to the college will vary according to the requirements of the service.

3. The dates of admission will be the 10th of February and 10th of September in each year.

4. The college terms will be—(*a*) from the 10th of February to the 30th of July, with suspension of study during a fortnight at Easter; (*b*) from the 10th of September to the 15th of December. The intermediate periods will constitute the vacations.

5. The Commander-in-Chief will be the president of the Royal Military College.

6. The college will be under the command of a governor, who will be solely responsible for discipline and for the general superintendence of the studies.

7. He will be assisted in the arrangement of the studies by a board, composed of the professors or senior instructors of the different branches. The head of each branch will have the general power of supervision and inspection over the studies in his department, with the duty of reporting on them to the governor.

8. The governor will be assisted by a staff officer, who will be responsible in his temporary absence for the charge of the establishment. This officer will have the custody of the records and the correspondence of the college, and will give the governor such assistance as he may require.

9. The quartermaster will perform the duties of acting commissary.

10. The sub-lieutenants, being commissioned officers, are under the Mutiny Act and Articles of War, and must conform to her Majesty's regulations in all respects. While resident at the college, they will be subject to such rules and regulations as are, or may be from time to time, established for the maintenance of good order and discipline.

11. The governor will have the power of removing for a period not beyond the corresponding period in the next term any sub-lieutenant guilty of insubordinate or ungentlemanlike conduct, or of repeated acts of irregularity, and will report the circumstances to his Royal Highness the Field Marshal Commanding-in-Chief.

12. Sub-lieutenants reported for habitual inattention to their studies, or failing to pass satisfactorily through the probationary examination at the end of their first term, will be specially brought under the notice of his Royal Highness, with a view to their cases being considered as to the necessity of removal from the college.

13. In cases requiring more serious notice, a student, if commissioned, will be liable, on the report of the governor to his Royal Highness, to be removed from the service, or, if not commissioned, to be removed from the list of candidates awaiting their commissions.

14. Sub-lieutenants who misconduct themselves during their residence at the college will be liable to the forfeiture of the antedate to which they would otherwise be entitled in accordance with par. 28. They will also, if temporarily removed from the college for misconduct, be liable, under the provisions of the royal warrant of the 15th of February 1875, to the forfeiture of pay for such period as the secretary of state may direct.

15. The sub-lieutenants will be distributed in divisions of not less than 25, each division being under the immediate charge of one of the professors or instructors selected by the governor.

16. The officers of divisions will be the channel of communication on all subjects between the sub-lieutenants and the governor. They will mess with their divisions, and will exercise a general superintendence over them, for which they will be responsible to the governor.

17. During the hours of study the sub-lieutenants will be under the charge of the professors and instructors, to whose orders they will be required to pay implicit obedience.

18. Sub-lieutenants will salute the governor and assistant to the governor on all occasions, whether in or out of uniform, and the professors and instructors when on duty, on parade, or when under instruction.

19. The sub-lieutenants will be required to appear at all times in uniform, except when on leave of absence, or otherwise exempted by the governor.

20. The study undress may be worn at all times when sub-lieutenants are under instruction, with the exception of riding or parade, when they will wear their undress uniform. The forage cap will be worn with the study undress.

21. The course of instruction for each sub-lieutenant will last during two terms. The following will be the subjects of study:—(*a*) Queen's Regulations and Orders for the Army, regimental interior economy, accounts, and correspondence; (*b*) military law; (*c*) the elements of tactics; (*d*) field fortification, and the elements of permanent fortification; (*e*) military topography and reconnaissance; (*f*) infantry and field artillery drill, riding, and gymnastics.

22. At the end of the course the sub-lieutenants will be required to pass an examination in the field and on paper, and those who pass the examination will be gazetted to regiments in which there may be vacancies for sub-lieutenants, with a view to their completing the period of service required before they can be promoted to the rank of lieutenant.

23. On the pass list of the examination prescribed in the foregoing paragraph, sub-lieutenants will be placed in one of three classes, according to their proficiency, as shown at the examination.

24. The examination will be qualifying, not competitive, and the candidates will be arranged alphabetically in each class.

25. The standard of qualification for the respective classes will be decided upon from time to time by the Secretary of State for War, and announced to the sub-lieutenants at the commencement of their course.

26. Marks will be allotted to the subjects in the following proportions:—Queen's Regulations, &c., 1½; military law, 2; elements of tactics, 3; fortification, 3; military topography and reconnaissance, 3.

27. In tactics, fortification, and military topography and reconnaissance, one-fourth of the marks will be reserved for notes and drawings done during the course.

28. In accordance with the power vested in the secretary of state by art. 3 of the royal warrant of the 30th October 1871, he has decided that the lieutenants' commissions of officers who pass in the 1st class will be antedated two years; and those of officers who pass in the 2nd class, 12 months. No antedate will be granted to officers who pass in the third class.

29. Every antedate will date back from two years subsequent to the date of the original commission as sub-lieutenant. No commission as lieutenant will be granted until the officer has served two years as sub-lieutenant.

30. Under the provisions of that portion of art. 3 of the royal warrant of the 30th of October 1871, which is amended by the royal warrant of the 30th of January 1875, sub-lieutenants may be removed from the service if they fail to pass the examination at the Royal Military College within two years from the date of their commissions as sub-lieutenants. They will be allowed to be re-examined once, at the Military College, provided two years from the date of their commissions as sub-lieutenants shall not have expired.

31. In order to ensure due diligence during the whole period of residence, there will be a probationary examination at the end of the first term in the work of the term. No sub-lieutenant will be permitted to reside for more than one year at the college, except in cases of protracted illness, or long absence from any unavoidable cause, or his being prevented from unavoidable cause from undergoing the final examination.

32. The mess rooms, ante-rooms, and quarters of the sub-lieutenants are furnished in all essentials by the government; plate, linen, and china, and every article of mess equipment, are supplied by the government, and no contributions on those accounts will be required from sub-lieutenants.

33. The messes will be conducted in every respect like a regimental mess, with strict regard to economy.

34. All unmarried officers of the college will be required to mess with the sub-lieutenants. Those officers who are married will mess with the sub-lieutenants if required to do so by the governor.

35. Sub-lieutenants will provide themselves, before they join the college, with the prescribed uniform, and with the books and instruments required for their instruction.

36. Sub-lieutenants will pay for their messing and washing. The amount due from each officer for his messing and washing will be paid by him monthly to the paymaster of the college.

37. All sub-lieutenants will be required to contribute a certain sum monthly to meet the expenses of a special laundry which has been found to be requisite.

38. No person whatever belonging to the Royal Military College will receive a present from any sub-lieutenant, or from the relations or friends of any sub-lieutenant.[*]

## IV.—EXAMINATION OF OFFICERS FOR PROMOTION TO THE RANK OF MAJOR.

Each candidate for promotion to the rank of major will in future be supplied with a contoured map, or sketch of ground similar to those used for the war game, upon which he will be required to delineate and explain the disposition of a combined force of the "three arms" under given conditions—1st, as an advance or rear guard; 2nd, on outposts; 3rd, for the attack or defence of a small chosen position. The examining board will be required to test the candidate's knowledge of the principles of combined movements, supply of ammunition, food, forage, &c., and system of regimental orderly-room work and correspondence by means of a *viva voce* examination. A set of questions on elementary tactics, as specified in the Sandhurst course, will be given. These questions, which are to be answered in writing, will not turn on knowledge of dates or details, but will be calculated to enable the candidate to show that he has studied some of the standard works on tatics, relating to the attack and defence of positions, and to advanced and rear guards and outposts. These questions will be supplied by the director-general of military education, to whom the answers will be transmitted for examination. In order to pass this part of the examination, the candidate must know thoroughly how to read a military map or plan. The following works may prove useful to officers preparing themselves for examination, in doing which they can also have the occasional assistance of the garrison instructors in the afternoon:—Hamley's 'Operations of War,' Clery's 'Minor Tactics' (Sandhurst text-book), Home's 'Précis of Tactics,' Boughey's 'Elements of Military Administration,' Simmons on 'Courts-martial,' and 'Soldier's Pocket-book.'

---

[*] Since the above rules came into force, another change in the admission of candidates for the army is about to take place. It is intended from January 1, 1877, to send cadets for the line and cavalry to Sandhurst, after passing their preliminary examination before the Civil Service Commissioners, to study at that college for their commissions, similar to what was formerly the custom. The rules on the subject have not yet been issued.

## V.—ROYAL WARRANT RELATIVE TO SUB-LIEUTENANTS.

Sub-lieutenants shall be removed from our army for moral or physical unfitness. They shall, except in the case of non-commissioned officers promoted to be sub-lieutenants, be required to pass the examination for the rank of lieutenant prescribed by the standing regulations for the promotion of sub-lieutenants in our infantry and cavalry of the line within two years from the date of their commissions, and the professional examination for the rank within the year next following, failing to do which they shall be removed from our service. Sub-lieutenants who shall twice fail to pass the examination prescribed by the aforesaid standing regulations may at once be removed from our service, notwithstanding that two years from the date of their appointment as sub-lieutenants shall not have expired. If appointed to regiments serving in India, the professional examination shall be passed within the first year from the date of their commissions, and the examination prescribed by the standing regulations for the promotion of sub-lieutenants in our cavalry and infantry of the line within the two years next following, subject to the like removal.

---

## VI.—FIRST APPOINTMENTS TO THE ARMY.

1. On the conclusion of a competitive examination, such successful candidates only shall be appointed to sub-lieutenancies as the requirements of the service at home and abroad may warrant.

2. Such successful candidates as cannot receive commissions as sub-lieutenants immediately shall undergo a course of instruction as students until such time as vacancies may occur to which they can be appointed as sub-lieutenants.

3. Sub-lieutenants, in order to qualify for the rank of lieutenant, shall be required to serve satisfactorily with one of our regiments for such period as shall from time to time be determined by our secretary of state, and either before or after such service (except in the case of non-commissioned officers promoted to be sub-lieutenants) shall go through such a course of study and pass such a professional examination as may be fixed from time to time.

---

## VII.—FORM OF DECLARATION TO BE SIGNED BY OFFICERS APPLYING FOR EXCHANGE AND ON PROMOTION.

The following is the declaration, on applying to exchange, to be made by the receiver:—

"I, A. B., hereby solemnly declare, on my honour as an officer and a gentleman, that the proposed exchange with C. D. does not originate in any cause affecting my honour or my character or professional efficiency; that it is my *bona fide* intention to join immediately and do duty with the corps to which I propose to exchange for at least a period of 12 months; and I further declare that none of the officers belonging to my present regiment, or to the regiment to which I propose to exchange, except C. D., have paid or promised to pay any money or money's worth to me, or, to the best of my knowledge and belief, to any person on my behalf or in my interest, directly or indirectly, in consideration of the proposed exchange; and I promise honourably and unreservedly not to receive or in any manner recognise any such payment on account of such exchange, either now or hereafter."

The declaration for the payer on applying to exchange contains similar clauses. The declaration on promotion is as follows:—

"I, A. B., hereby declare, on my honour as an officer and a gentleman, that I have not, nor to the best of my belief has any person on my behalf or in my interest, directly or indirectly, paid or transferred, or agreed to pay or transfer, any sum of money, valuable security, or other thing in respect of my promotion to the rank of ——, or, since the 1st of November 1871, in respect of my steps in the regiment leading to such promotion; and I promise honourably and unreservedly not to make, or cause to be made, in any way hereafter any such payment or transfer in respect of such promotion."

## VIII.—STAFF COLLEGE.

I. The Staff College is open to officers of all arms of the service, and shall consist of 40 students; admission to the college being determined by a competitive examination. Only one officer at a time can belong to the college from a battalion of infantry, or a regiment of cavalry, and only ten officers at a time from the two corps of royal artillery and royal engineers, but, so far as the exigencies of the service shall permit, there will be no limitation to the numbers allowed to compete for admission. Every application to study at the Staff College must be made whilst the officer making it is present and serving with his regiment, through the commanding officer. No application from an officer on leave will be entertained, and officers are not to be granted leave to be absent from their regiments or depots with the view of preparing themselves to compete for admission to the Staff College.

II. Twenty vacancies will be offered for competition annually, three of which may be filled by officers of the royal artillery and two by officers of the royal engineers, provided they are among the twenty candidates highest on the list. The principle under which officers are allowed to enter the Staff College being that of pure competition, it follows that candidates who may be found qualified at any examination, but who, from want of a sufficient number of vacancies, cannot then be admitted, will not have any claim to subsequent admission without undergoing another competitive examination.

III. No payment is required from students to the funds of the college, beyond an entrance fee of £3 from an unmarried and £1 10s. from a married officer, as a contribution to the college mess funds in addition to the regulated quarterly subscription; and an entrance subscription of £3 3s. to the college library.

IV. The qualifications requisite for admission are—

(*a*) A service of not less than five years, previous to examination, exclusive of leave of absence.*

(*b*) A certificate from his commanding officer, that the candidate is in every respect a thoroughly good regimental officer.

(*c*) A report on the following questions, to be confidentially answered by a board, consisting of the commanding officer and the two next senior officers of the candidate's regiment,† viz.:—

Is his conduct marked by steadiness and prudence, and is he temperate in his habits?

Is he extravagant in his mode of living?

Does he display zeal, activity, intelligence, and discretion, in the performance of his duties, and does he appear to take an interest in his profession?

Report any other characteristic of the officer which renders him suited or otherwise for the duties of a staff officer.

Is his disposition such as would enable him to perform those duties with tact and discrimination, and in a manner calculated to ensure their being cheerfully carried out by those to whom orders would be conveyed by him; or are his manners and temper objectionable, and likely to cause him to disagree with those with whom he might be associated or be brought in contact?

---

* This is not to apply to the usual leave of absence annually granted to officers on home service.

† Officers on half-pay whose regiments have been disbanded are, if possible, to obtain answers to these *questions from the* three senior officers under whom they have most recently *served.*

Is he active and energetic in his habits?

Is he a good (fair or indifferent) rider, and is he short-sighted?

(*d*) A certificate that the candidate, if not a captain, has passed the examination for a troop or company.

(*e*) A medical certificate of good health and fitness for the active duties of the staff.

V. Every application to study at the Staff College must be made through his commanding officer, whilst the officer is present and serving with his regiment. No application from an officer on leave will be entertained.

VI. Every candidate, before being admitted to the entrance examination, will, if practicable, be attached for a month to the staff of a general officer commanding a brigade or division, who at the expiration of this period will report confidentially upon the candidate's general fitness for staff employment, and especially upon his aptitude for business and for conducting official correspondence.

VII. The competitive examination for entrance to the Staff College comprises the following subjects, the relative value of each at the examination being shown by the number of marks attached to it:—

| | Marks. |
|---|---|
| Mathematics, limited to arithmetic, algebra, geometry, plane trigonometry, and elementary mechanics | 900 |
| Military history and geography | 900 |
| French | 300 |
| German | 300 |
| Hindustani | 300 |
| Fortification | 600 |
| Military drawing | 300 |
| Geology, exclusive of mineralogy | 300 |
| Chemistry, heat, electricity, and magnetism | 300 |

A qualification will be exacted from every candidate in—

1. Mathematics. 400 marks will be allotted to arithmetic, the first four books of Euclid, and algebra as far as simple equations inclusive; and of this number, at least 250 must be obtained for qualification.
2. Either French, German, or Hindustani. The qualifying minimum is, in French, 150 marks; in German or Hindustani, 100 marks.
3. Elementary field fortification. One-third of 150 marks, to be assigned to a simple paper, will be required as the qualification in this subject.

VIII. The remaining subjects, as well as the higher portions of mathematics, may be taken up or not, at the option of the candidate, the marks gained therein and in the obligatory subjects, after deducting 60 from the marks gained in each voluntary subject, being reckoned in determining his position in the list of competitors.

IX. In regard to military history, early notice will on each occasion be given of the special campaigns on which questions will be set at the next ensuing examination.

X. The examination of officers serving in the United Kingdom, for entrance to the Staff College, is held in London, about the month of June, under the direction of the director-general of military education. (See par. xxix.)

XI. In the case of officers serving abroad, the examination is conducted by means of the same printed questions as are set for the examination of candidates in London. These questions are to be answered in writing in the presence of a board of officers, which will be appointed by the general officer in command, and which will certify that the candidate has obtained no assistance from books, or help of any kind in the examination. (See par. xxx.)

XII. Notice will be given of each examination, and detailed instructions for the guidance of candidates will be published annually in the General Orders of the Army. Candidates are recommended to obtain the reports of the past examinations for admission, with copies of the examination papers, published by Taylor and Francis, Red Lion Court, Fleet Street.

XIII. The college course of study commences annually on or about the 1st of February. The transmission of the printed examination papers to stations abroad is so arranged that the examinations may be held simultaneously, and the merits of the candidates decided upon in time to admit of those who are successful joining the Staff College by the 1st February next ensuing.

XIV. A synopsis of the course of study will be forwarded to any officer on application to the director-general of military education, War Office.

XV. The following are the subjects of instruction at the Staff College, viz. :—

### OBLIGATORY.

1. Mathematics (first year only).
2. Fortification and field engineering.
3. Artillery.
4. Topographical drawing, military surveying and sketching, and road making.
5. Reconnaissance.
6. Military art, history, and geography.
7. Military administration and law.
8. French, or German, or Hindustani.
9. Riding.

N.B.—Instruction in mathematics is limited to the first year, and will comprise mensuration, the mode of determining heights and distances by ground problems, and by the ordinary trigonometrical calculations with the aid of logarithms, the use of the sextant, and elementary mechanics.

### VOLUNTARY.

1. The two languages not selected as obligatory.
2. Geology, exclusive of mineralogy.
3. Experimental sciences.
4. Photography.
5. Military telegraphy.

Officers desirous of showing their proficiency in any or all of the above subjects, as well as in other modern languages not taught at the college, and in landscape drawing, may be examined therein, and a special report of their qualifications in each subject will be made to the Field Marshal Commanding-in-Chief, provided they obtain three-fifths of the maximum allotted to that subject; but they will not be allowed to count any marks thus gained at the final examination.

XVI. The course of study occupies two years, which period is not to be exceeded except in case of illness, and then only with the sanction of the Field Marshal Commanding-in-Chief. The commandant, in arranging the details of the course of instruction, will be assisted by a college board composed of the professors.

XVII. The yearly course is divided into two terms, viz. from the 1st February to the 15th July, and from the 1st September to the 15th December, the intervening periods constituting the vacations.

XVIII. Confidential reports as to the character and abilities of every officer at the college, and his qualifications for staff employment, will be forwarded at the end of every term by the commandant to the Field Marshal Commanding-in-Chief, and any student who is reported unlikely to make an efficient staff officer will be required to leave the college. Examinations are held at the end of every half-year; the summer examinations being conducted by the professors of the college, and the winter examinations by examiners independent of the establishment.

XIX. The examination at the end of the second term is probationary, and any student will be required to withdraw from the college who shall fail to obtain the minimum aggregate of marks. The marks gained at this examination will not be carried on to the credit of students at the final examination, except those gained in mathematics,

The subjects of the probationary examination, with the proportions of credits attached, will be as follows:—

| | |
|---|---|
| 1. Mathematics | 3 |
| 2. Fortification | 3 |
| 3. Military history | 3 |
| 4. Topographical drawing, military surveying, and sketching | 2½ |
| 5. Military administration | 3 |
| 6. French, German, or Hindustani | 2 |

The minimum aggregate required for pass at the probationary examination is ·55. The counting minimum in each subject is ·4.

XX. Should, moreover, any marked case of deficiency or neglect be brought under the notice of the director-general of military education, at any half-yearly examination, or at any other period, the student so reported will be liable to removal.

## Final Examination.

XXI. At the end of the second year a final examination will be held for the purpose of testing the general proficiency of the students in the obligatory subjects of the college course, as well as the qualifications of other officers who, under art. xxv., may be admitted to the examination.

Credit will be given to each subject at the final examination in the following proportions:—

| | | |
|---|---|---|
| 1. | Fortifications, field engineering, and artillery | 6 |
| 2. | Military drawing and surveying, &c. | 2½ |
| 3. | Reconnaissance | 4½ |
| 4. | Military art, history, and geography | 6 |
| 5. | Military administration | 4 |
| | Military law | 2 |
| 6. | French, German, or Hindustani | 4 |
| 7. | Mathematics | 3* |

XXII. In the examination in modern languages great stress will be laid on original composition, and on colloquial knowledge.

XXIII. For qualification the students will be required to obtain ·55 on the aggregate allotted to the seven obligatory subjects mentioned in art. xxi., the counting minimum in each subject being ·4. For "honours" they must gain ·8 on that aggregate of marks. For "special mention" in any subject ·9 must be obtained.

XXIV. After the final examination the director-general of military education will draw up and submit to the Field Marshal Commanding-in-Chief a list of the passed candidates, arranged in the order of seniority of their regiments, distinguishing those who have gained "honours."

XXV. Officers of all branches of the service shall be allowed to pass the final examination at the Staff College (subject to the following restrictions), without having gone through the course of instruction at the college. Candidates presenting themselves for the final examination without having gone through the course of instruction must have a previous service of seven years, and similar qualifications in other respects to those exacted (in art. iv.) from candidates for admission to the Staff College.

---

* Marks brought forward from the probationary examination.

Previous to the time appointed for the final examination, they must reside at the college for such a period in the months of October and November, as may be necessary to allow of their taking part in the examination in reconnaissance, and of their being tested under the direction of the commandant in the practical subjects of instruction at the college.

They must also pass the qualifying examination in mathematics prescribed in art. vii. They will also be tested in riding.

XXVI. Officers who have passed their final examination at the Staff College will either—

1. Be attached for three months, during the following summer drill season, to the staff of a general officer at some camp where all the three arms of the service are present. During this period they shall be regularly employed as acting staff officers, and shall be required to make themselves acquainted with the organisation of the several arms, and with the combined movements of troops. At the end of three months a confidential report shall be forwarded by the general officer, stating minutely their abilities, the manner in which they have performed their duties, and the department of the staff for which they appear to be most fit; or—
2. Be attached, during the following summer drill season, to other arms of the service, for the purpose of acquiring instruction in those duties and field movements which are not common to their own. Certificates of their efficiency therein will be forwarded to the adjutant-general by the officers commanding the corps to which they have been attached.

   Officers of cavalry and infantry will attend at Woolwich, or such other station as may be named, for instruction in artillery for a period of two months.

   Officers of cavalry will be attached to infantry for two months.

   Officers of artillery, horse artillery excepted, will be attached to cavalry for one month, and officers of engineers and infantry for two months.

   Officers of artillery and engineers will not be required to be attached to infantry.

XXVII. Candidates who shall have proved their fitness for employment in the topographical department of the War Office, by a superior knowledge of French and German, as well as of topography, will be named in the report of the director-general of military education as qualified for employment in that department.

XXVIII. Officers who fail either at the probationary examination, or at the final examination, whether they have or have not gone through the course of instruction at the college, will not be allowed to present themselves again, either for admission to the college or at the final examination under art. xxv.

### HOME STATIONS.

XXIX. Officers serving in the United Kingdom who are desirous of entering the Staff College must, before a date which will be made known, inform their commanding officers, by whom the certificates from (*a*) to (*e*), par. iv., will be prepared and forwarded through the usual channel to the adjutant-general of the forces. General officers, in transmitting these applications, will record their opinions as to the fitness or otherwise of the applicants for staff work, should they be able to do so from their personal knowledge of them.

If these certificates are satisfactory, orders will be issued for carrying out the test prescribed in par. vi.

General officers will report not later than 20th May upon the candidates then attached to their staff; after which date the officers, if approved, will receive, from the director-general of military education, the rules to be observed at their examination.

The examination will take place in London on a date which will be made known by the Civil Service Commissioners.

### FOREIGN STATIONS.

XXX. General officers commanding abroad will issue their own local orders specifying the date up to which applications will be received by them from officers wishing to be examined. Care should be taken that sufficient time is allowed for the qualification described in par. vi. to be obtained, so that all the necessary papers and certificates may be received at the Horse Guards on or before the 1st May.

General officers, in forwarding these applications, will carry out the instructions laid down in par. xxix.

The examination papers will be sent out for those officers only whose applications shall have been thus received.

XXXI. The examination will commence on the 8th June, or as soon after that date as the examination papers shall be received from the director-general of military education; but no examination can be allowed to commence after the 30th June.

A board of officers will be appointed at the most convenient station of the district, by the general officer in command, and will consist of three officers; one of them to be, when practicable, a staff officer, having the rank of field officer, and the other two, if possible, not under the rank of captain. One of these officers will belong to one of the scientific corps, where any such officer can be obtained.

The questions are to be answered in the presence of the board.

The board will give to each candidate a number, which he will affix to each of his examination papers, instead of his name. He will retain the same number throughout the examination.

The board will give to each candidate a paper of the printed examination question on each subject, at the time specified for the examination in that subject.

The candidates will write their answers to the questions in the presence of the board, and their papers, together with the printed examination questions, will be collected at the hour appointed, and made up into a packet, which will be sealed before being taken from the examination room.

The board will, immediately on the conclusion of the examination, forward the papers of the candidates to the general officer commanding, for transmission to the director-general of military education, accompanied by a certificate that the candidates obtained no assistance from books, or help of any kind, in their examination. The board will, at the same time, forward the names of the candidates, corresponding with their index numbers in the examination, in a separate envelope, for transmission to the director-general of military education.

XXXII. The following will be the order of the examination:—

| | |
|---|---|
| 1st day: | |
| Military drawing | 3 hours. |
| Hindustani | 3 „ |
| 2nd day: | |
| Fortification—(Obligatory) | 1½ „ |
| „ (Voluntary)—1st paper | 1½ „ |
| „ (Ditto) 2nd paper | 3 „ |

| | |
|---|---|
| 3rd day: | |
| Mathematics—(Obligatory)—1st paper | 3 hours. |
| " (Ditto) 2nd paper | 3 " |
| 4th day: | |
| Mathematics—(Voluntary)—1st paper | 3 " |
| " (Ditto) 2nd paper | 3 " |
| 5th day: | |
| Military history and geography—1st paper | 3 " |
| " " 2nd paper | 3 " |
| 6th day: | |
| French | 3 " |
| Chemistry | 3 " |
| 7th day: | |
| German | 3 " |
| Geology | 3 " |

XXXIII. The examination in military history and geography will comprise the following subjects, as stated in G.O. 70 of 1874, viz.:—

*a. The campaign of* 1809 *in Germany.*

Candidates will be expected to have a general knowledge of the geography of the country.

*b. The general principles of war.* Text-books: Jomini, 'L'Art de la Guerre;' Hamley, 'Operations of War.'

XXXIV. There will be, in all cases, an interval of not less than one hour between the two periods of examination on each day.

The papers will be collected at the appointed hours by a member of the board. Any candidate however, who may have finished his examination paper on any subject before the hour named, may deliver it into the hands of a member of the board.

Paper, pens, and ink will be provided, but candidates should bring their writing and drawing materials, instruments, &c., and also the tables of logarithms they are in the habit of using. No other books or notes of any description will be allowed to be used.

No communication whatever will be allowed between the candidates at the examination.

XXXV. General officers commanding at foreign stations will place no restrictions upon officers competing, further than the exigencies of the service may absolutely require. It will be understood that the rule by which only one officer can be spared from a battalion at a time, for the purpose of studying at the Staff College, does not apply to candidates from battalions which have officers now at the college, but whose course of study will terminate in the following December.

XXXVI. General officers commanding at foreign stations will select the hours for the examination which are best suited to the climate and circumstances of the country, taking care, however, to conform strictly to the number and distribution of the hours, as detailed in the foregoing regulations.

XXXVII. On the completion of the examinations, general officers commanding will transmit the candidates' papers to the director-general of military education, War Office, Pall Mall, with the least possible delay, in order to enable officers from distant stations who may be successful in the competition, to join the college early in the following February. They will at the same time forward to the adjutant-general a return of the officers examined.

XXXVIII. Officers serving abroad, who may be successful candidates, will be allowed passage home, on joining the Staff College.

XXXIX. The names and examination numbers of the candidates who are successful in the competition, as well as of those who prove themselves qualified, but for whom there are no vacancies, and the examination numbers alone of candidates who fail, will be published immediately after the reports of the examiners have been received by the director-general of military education, with the total number of marks gained by each candidate, and his place on the list.

XL. Candidates are recommended to obtain the reports of past examinations for admission, with copies of the examination papers, published by Messrs. Taylor and Francis, Red Lion Court, Fleet Street, London.

## IX.—REGULATIONS FOR THE ENTRY AND EXAMINATIONS OF CANDIDATES FOR COMMISSIONS IN THE ROYAL MARINE ARTILLERY AND LIGHT INFANTRY.

### Royal Naval College.

I. A limited number of candidates will be nominated to compete for admission into the Royal Naval College, Greenwich, as probationary lieutenants in the royal marines.

II. The examination will be conducted by the Civil Service Commissioners, and will be held once a year, commencing on the second Wednesday in August.

III. No candidate will be eligible who is under 16½ or above 18 years of age on the 1st of October following the examination.

IV. Public notice will be given in May of each year of the number of vacancies, and of the number of candidates to be nominated to compete for them.

V. A candidate who qualifies, but is not successful in the competition, will be allowed to compete again at the next examination if not over age; but a candidate who fails to qualify will not be admitted to compete again; and no candidate will be allowed to compete more than twice.

VI. Every candidate will be required to be at least 5 feet 5 inches in height and to pass the medical examination according to the prescribed regulation, under the direction of the medical director-general of the navy. He must be in good health, and free from any physical defect of body, impediment of speech, defect of sight or hearing, and also from any predisposition to constitutional or hereditary disease, or weakness of any kind, and must be in all respects well developed, and active in proportion to his age. Any candidate rejected at the medical examination will, subject to the approval of the board, be finally excluded from the royal marines.

VII. Each candidate, before the examination, will be required to produce the following certificates, viz.:—(1) A registrar's certificate of birth,* or declaration thereof made before a magistrate. (2) A certificate of good conduct for the two years previous from the masters of the schools at which he may have been educated; or, if educated at home, from his tutors, or the clergyman of the parish in which he has resided for that period. (3) A certificate of good health and physical development from the medical director-general. (4) A certificate of height.

VIII. A candidate will be required to pass a preliminary examination in the following subjects, the maximum number of marks obtainable for each being as stated:—

| | Marks. |
|---|---|
| 1. Writing English from dictation correctly in a good legible hand. No marks allowed. | |
| 2. Arithmetic .. .. .. .. .. .. .. | 300 |
| 3. Algebra (including quadratic equations and the three progressions) .. .. .. .. .. .. .. | 500 |
| 4. Geometry (up to the standard of the sixth book of Euclid's Elements) .. .. .. .. .. .. .. | 600 |
| 5. Plane trigonometry (including definitions, fundamental formulæ, and the solution of plane triangles) .. .. .. | 600 |
| | 2000 |

---

* A certificate of baptism will not be accepted.

IX. The further examination will be proceeded with immediately on the conclusion of the preliminary examination. Candidates who fail in the preliminary examination will be informed of their failure as soon as possible, and they will then be released from further attendance.

X. The subjects of the further examination and the maximum of marks obtainable for each subject will be as follows:—

| | | Maximum Marks. |
|---|---|---|
| 1. | Applied mathematics (viz. elementary statics, dynamics, and hydrostatics) | 1000 |
| 2. | Physics (viz. sound, light, heat, magnetism, and electricity) | 1000 |
| 3. | Chemistry | 600 |
| 4. | Latin | 1500 |
| 5. | Greek | 1000 |
| 6. | English language and composition | 1000 |
| 7. | History, ancient and modern, with geography | 1000 |
| 8. | French | 1000 |
| 9. | German, Spanish, or Italian | 1000 |
| 10. | Drawing: Freehand | 400 |
| | Drawing: Geometrical | 400 |
| | | 9900 |

XI. A candidate may be examined in as many of the above subjects as he chooses. A certain number, corresponding to a merely elementary knowledge, will be deducted from the marks gained by a candidate in each subject, except drawing and applied mathematics.

XII. To qualify, a candidate must pass to the satisfaction of the Civil Service Commissioners in the subjects specified in par. viii., and in two at least of the subjects of the further examination. He must also obtain such an aggregate of marks as shall indicate, in the judgment of the commissioners, a competent amount of general proficiency.

XIII. The successful candidates will be appointed lieutenants on probation. They will proceed to the Royal Naval College at Greenwich at the commencement of the session following the examination, viz. on the 1st of October.

XIV. At the end of the first session they will be examined, and commissions in the light infantry will be granted to all who shall pass a satisfactory examination. The dates of the commissions so granted will depend upon the number of marks obtained. Those who do not pass satisfactorily will be finally excluded from the royal marines.

XV. From those who pass highest at this examination, officers will be selected to qualify themselves to fill vacancies in the royal marine artillery.

XVI. The officers thus selected will remain at the college a second session, at the end of which they will be examined, and, if they pass satisfactorily, will receive commissions in the artillery.

XVII. Officers who fail to obtain commissions in the artillery may retain their rank as lieutenants in the light infantry.

XVIII. Artillery and infantry officers will be posted on the list of their respective corps in the order in which they pass their final examination at Greenwich.

XIX. Officers of the royal marines on probation will receive 5s. 3d. a day. Those who are permitted to remain a second session to qualify for the artillery will be allowed 1s. 6d. a day mess allowance during that session.

XX. Officers, on passing out, will join their respective divisions, and be instructed in their drill and military duties for service ashore and afloat.

XXI. Each successful candidate at the examination for entry must deposit the sum of £80 with the accountant-general of the navy before he can be appointed lieutenant on probation for the royal marines, to provide for his equipment at the Royal Naval College and on joining his division.

XXII. The uniform for officers on probation will be blue patrol jacket, blue working jacket, mess jacket, undress trowsers, sword, and forage cap.

---

## X.—AUXILIARY FORCES.

### APPOINTMENTS OF LIEUTENANTS OF MILITIA TO COMMISSIONS IN THE REGULAR ARMY.

1. The officers commanding certain militia regiments will be permitted to recommend one or more lieutenants of their regiments (having reference to the orders of the Commander-in-Chief on this head) for commissions in the army, and others one lieutenant.

2. They will report to the military secretary, through the officer commanding the subdistrict and the general officer commanding the district, before the 1st of April, whether they will be prepared to recommend a candidate or candidates, as the case may be, for such commissions or not.

3. If no intimation be received prior to or on that date, it will be taken for granted that the commanding officer has no candidate to recommend, and the commission will be offered to the regiment next on the roster, which is not included in the number detailed for commissions during the present year.

4. The arrangements for granting commissions in the regular forces to militia regiments being based on the system of giving one commission for each company in every 10 years, regiments consisting of more than 10 companies will occasionally receive two commissions in a year, and regiments below that strength will in some years get no commission.

5. When questions of priority arise, the seniority of a regiment of militia will be determined by its numerical sequence, or, in the event of a regiment not having a number, by its alphabetical order.

6. A lieutenant of militia recommended for a commission in the army must be within the ages of 19 and 22 on a certain date, which will be promulgated by the Commander-in-Chief; but a lieutenant who entered the militia between the 16th of February and 1st of November 1871 will be eligible for a commission until he attains the age of 23 years.

7. Before a lieutenant of militia can be granted a commission as lieutenant in the army, he will be required—(*a*) To have served two annual trainings. (*b*) To obtain a certificate (W. O. Form 1672) from a board of examination that he is thoroughly acquainted with the following subjects:—(1) The first two parts of the 'Field Exercises of the Infantry' and the command of a company in battalion. (2) Rifle drill and practice, and the theoretical principles of musketry, as defined in the authorised book of instruction. (3) The duties of regimental orderly officers, of officers commanding guards, and of subaltern officers of guards under officers of superior rank, and the mode of marching reliefs, and posting sentries. (4) Those portions of the Queen's Regulations and Orders for the Army which relate to the duties and conduct of a subaltern officer, and the Mutiny Act and Articles of War so far as is necessary for the performance of the duties of a member of a court-martial. (5) The regulations for the army in regard to the pay and messing of the troops, the supply of clothing and necessaries, and all details regarding the mode of carrying the various articles of the soldier's kit, arms, accoutrements, and ammunition. (*c*) To be recommended by his commanding officer, the recommendation being confirmed by the officer commanding the subdistrict and the general officer commanding the district (in the case of the Channel Islands militia the recommendation must be confirmed by the lieutenant-governor). (*d*) To have

passed the examination prescribed to be passed before the Civil Service Commissioners, or to produce an university certificate as prescribed by regulation.

8. The examination for the certificate (W. O. Form 1672) will, as a general rule, be held during the training; and in applying for the assembly of the board of officers for this purpose, the commanding officer of the militia regiment will state that the officer on whose behalf he applies has been nominated by him, and is qualified as regards age and service.

9. The proceedings of the board of examination will be transmitted to the general officer commanding the district for approval, together with the certificate (W. O. Form 1672), if granted by the board. In the event of the regiment training out of its district, or of the board of examination, for some other reasons, being held out of it, the general officer concerned will transmit the proceedings of the board to the general officer commanding the district to which the militia regiment belongs. If the certificate be approved, the general officer commanding will notify the same to the officer commanding the subdistrict, who will call upon the officer commanding the militia regiment to forward his recommendation of the candidate. If the officer does not obtain the certificate, the proceedings will be forwarded by the general officer commanding in question to the adjutant-general.

10. The recommendation will be forwarded as soon as possible after the 1st of May in the case of officers who have already served two trainings, and in other cases immediately after the conclusion of the annual training through the officer commanding the subdistrict. It will be accompanied by (*a*) a certificate that, as required by par. 7 (*a*), the officer has served two trainings; (*b*) an extract from the register of the officer's birth, or, in default, a declaration made by one of his parents or guardians before a magistrate, giving his exact age (a certificate of baptism cannot be accepted in lieu of a certificate of birth); (*c*) the certificate referred to, in the case of an officer exempted from examination before the Civil Service Commissioners in virtue of an university qualification.

11. The general officer commanding the district, on receipt of this recommendation, will attach the proceedings of the board and the certificate (*c*) (W. O. Form 1672), referred to in par. 9, and forward the whole of the documents, with his report of the case, to the military secretary.

12. When an officer has within two years obtained a certificate of qualification in drill at a school of instruction or from a board of officers, he will be examined for a certificate (W. O. Form 1672) only in the additional subjects in which he has not already passed. In this case the board, in granting their certificate, will quote and annex the certificate previously obtained by the candidate.

13. The examinations of lieutenants of militia recommended for army commissions during the present year will take place before the Civil Service Commissioners at the University of London, Burlington Gardens, when directed by the Commander-in-Chief, and arrangements will be made for the medical examination at the time.

14. No candidate will be allowed to appear for examination before the Civil Service Commissioners until he has been examined by a medical board as to his fitness in respect of height and physical qualifications for her Majesty's service.

15. An officer who fails in his first examination will be allowed two further trials at the two next ensuing periodical examinations for entrance to the army. An officer who finally fails to pass at these examinations will not be permitted to be nominated for a commission in any subsequent year.

16. An officer serving in the militia may compete for an army commission. If he is successful, and is gazetted to a regiment, he cannot afterwards be recommended as a militia officer.

17. The circumstance of a lieutenant of militia having been an unsuccessful candidate at the competitive examinations for commissions in the army will not preclude his being nominated for a line commission by his commanding officer under the present regulations. If so nominated, he will, unless he can produce the university certificate referred to in par. 7 (*d*) of these regulations, be required

to pass the qualifying examination prescribed, but the Civil Service Commissioners may, if they think fit, dispense with such qualifying examination in the case of any candidate who, at a previous competitive examination, has shown that he possesses the necessary qualifications.

18. Officers commanding militia regiments are requested to draw the attention of subalterns to the revised regulations respecting the "instruction of sub-lieutenants of the regular forces and their examination for promotion," contained in General Order 46 of 1874, in order that subalterns desirous of entering the army may be fully aware of the position in which they may stand, with reference to sub-lieutenants who obtain their commissions in the army by open competition, and who have in certain cases an antedate given to their commissions as lieutenants.

## XI.—VOLUNTEERS.

### "EFFICIENT."

A volunteer shall be entitled to be deemed an efficient volunteer if he obtains a certificate certifying that he has fulfilled the requirements and possesses the qualifications stated upon such form of certificate, and not otherwise. Every such certificate shall be granted as soon as may be after the 31st day of October in every year, and shall bear date the 1st day of November, and shall be evidence of the efficiency of the volunteer to whom it is granted during the year ending the 31st day of October next following its date. Every volunteer fulfilling the requirements and possessing the qualifications aforesaid shall be entitled to receive such a certificate of efficiency. But no volunteer who is absent from the annual inspection of his corps, unless so absent with the leave of his commanding officer or through sickness, duly certified, shall be entitled to such certificate. In the course of each year ending the 31st day of October, the adjutant of each corps or administrative regiment shall select from time to time such volunteers as in his opinion have fulfilled the requirements and possess the qualifications aforesaid, and submit their names to the commanding officer of their corps with a view to their obtaining certificates of efficiency. If the adjutant refuses to recommend any volunteer for a certificate, and the volunteer considers himself aggrieved thereby, the volunteer may appeal to the commanding officer of his corps. If the commanding officer concurs in the adjutant's recommendation or refusal to recommend, he shall either sign the certificate or else approve the withholding of it, as the case may be; but if he differs from the opinion of the adjutant, he shall refer the matter to the officer appointed by one of her Majesty's principal secretaries of state to act in that behalf, whose decision shall be final, and who shall sign the certificate if he think it ought to be granted, instead of its being signed by the commanding officer and adjutant. When a corps is by its own default not inspected during the year, or when the officer inspecting a volunteer corps at the annual inspection in any year reports that the corps is not proficient in drill and instruction to his satisfaction, then, notwithstanding anything hereinbefore provided, one of her Majesty's principal secretaries of state shall have power to direct the withholding of certificates of efficiency at the end of that year from all volunteers belonging to the corps. The inspecting officer at the annual inspection in any year shall have power to direct the withholding of a certificate for or in respect of any volunteer in any case in which he considers it proper to do so, on account of the want of proficiency in drill or instruction of that volunteer, or on account of his sword, carbine, or rifle, as the case may be, being in bad order or condition. If in any one year a volunteer is resident during the drill season of his corps at a greater distance than 10 miles from its head-quarters, he may (with the written consent of both commanding officers) be attached for drill purposes to another corps. In such case all his drills for efficiency, including attendance at inspection, must be performed with that corps, but he must wear the uniform of his own corps. The term "recruit" used upon the form of certificate means a volunteer who has never served for at least six months in her Majesty's regular forces, or served and attended training in a regiment of militia, or who has never been returned as an efficient in an annual return of a volunteer corps.

### UNIFORM.

The question of the assimilation of uniform in the volunteer force, which has been frequently raised during the past few years, has received increased attention since the various administrative battalions and corps of rifle volunteers have formed part of the brigades of the infantry subdistricts, and it is satisfactory to observe that decided action has been taken in the matter by the War Office authorities, and that the new regulations respecting the clothing of the force have met with the approval of the Secretary of State for War. The regulations on the subject, which, as far as regards officers, have received an addition within the past few days, state that any applications from corps or battalions to change the colour of the uniform to that of the line battalions of the brigade to which they belong will be favourably considered; so that in any changes which may be made, scarlet, no doubt, will take the place of the grey, green, or black. At the same time, it is distinctly stated that no corps will be "compelled" to adopt a uniform of a different colour from that now worn, except in the case of those administrative regiments in which the several corps are not clothed alike. Where a difference exists in the clothing or appointments of the corps composing an administrative regiment, the commanding officer will have to submit to the secretary of state, through the general officer commanding the district, the patterns he proposes to adopt for the regiment, all the corps of which will be required to conform to the approved patterns before the 1st of April 1879. With the exception of this change, "no alteration of the colour of the uniform of a volunteer corps will be permitted, except for the purpose of assimilation to one of the line regiments of its subdistrict brigade." In the event of any corps of light horse or mounted rifle volunteers applying for authority to change its uniform, scarlet will be the colour authorised, and, in order that the several arms of the force may be distinguished from corresponding arms of the regular army and militia, the following rules will be observed:—

"Artillery volunters will wear red, and engineer volunteers white, cord. Artillery volunteers will also wear a red, and engineer volunteers a white band and button on the forage cap. Any change rendered necessary by this regulation will be carried out before the 1st of April 1879. All regiments clothed in green will wear on the sleeve a light green scroll, and those clothed in blue a scarlet scroll. Regiments clothed in scarlet will wear a scroll of the colour of their facings, unless the facings should be scarlet, in which case a dark blue or black scroll will be worn. This scroll, which will be of flat braid, in the form of an Austrian knot, must be adopted before the 1st of April 1875. Respecting officers, those in rifle regiments clothed in scarlet, grey, or green, will wear the pattern of cord and braid on the sleeve of rifle regiments of the regular forces:—For scarlet uniforms, silver cord and braid; for grey, cord and braid of silver; and for green, black cord, with light green edging. Officers will also wear gold in the badges of rank on the collar where silver is worn by the officers of the regular forces. The other principal regulations are as follows:—

"It is desirable that all regiments clothed in green should adopt green facings of the same shade as their uniform. In rifle volunteer corps wearing the busby, the feathers or horsehair on the lower part of the plume will be of light green when corps are clothed in green, and of the colour of the facings when corps are clothed in scarlet or grey. Volunteers will wear on their shoulder-straps the initials of their county and the number of their corps in the county, and if they belong to a *corps in an* administrative regiment, the number also of their brigade or battalion. Light horse, artillery, engineers, and mounted rifle volunteers will also wear letters denoting the branches of the service to which they respectively belong. The stars to be worn by proficient sergeants will be similar to those worn in the badges for good shooting, but of 1½ inch instead of ½ inch diameter. The star worn by a volunteer who has been five times returned as efficient will be of five points. It is desirable that corps clothed in blue or scarlet should wear white belts, expense pouches white, large pouches black; corps clothed in green, black belts and pouches; and those in grey, black or brown belts and pouches. In the event of changes of uniform, accoutrements will only be authorised in accordance with the preceding paragraph, and any new corps raised, unless forming part of an administrative regiment otherwise accoutred, will strictly conform to the provisions of that paragraph. Officers will wear cross-belts and pouches. The infantry sash will not be worn by officers or sergeants. Neither gold lace nor brass ornaments are to be worn by volunteer corps. The distinctions in uniform and appointments which are prescribed in the regular service and militia to denote the rank of the wearer should be strictly observed by volunteers of the various grades as far as they are applicable to the volunteer force. In this respect the dress regulations for the army are to be taken as a guide. Corps will not adopt any undress without authority. No change whatever (either as regards alteration or addition) will be made without authority obtained from the secretary of state, through the general officer commanding the district."

Some of the regulations enumerated above will take effect in 1876, others again as late as 1879.

### APPOINTMENT OF ADJUTANTS.

The following circular in relation to the appointment of adjutants to volunteer corps has been issued from the War Office :—

"In the event of an adjutancy becoming vacant, either by death or retirement, the commanding officer of the administrative regiment or corps of volunteers in which the vacancy has occurred, if he should have any very special reason for wishing to obtain the services of any particular officer to succeed to the appointment, will make his application through the proper channel to the adjutant-general. In the case of a retirement, the application will not be made until the retirement shall have been notified in the *London Gazette.* The commanding officer will state, in his application, the exceptional qualification which, in his opinion, renders it desirable that the officer referred to should be appointed in preference to any other candidate who may in other respects be equally eligible. The secretary of state disapproves commanding officers of volunteers communicating direct with commanding or other officers of the army, with a view of finding suitable candidates. They should clearly understand that the selection of officers for appointment as adjutants does not rest with commanding officers of volunteers, who should not make any recommendation on the subject, except under the special circumstances above detailed."

# APPENDIX B.

## LIST OF SERVICE ORDNANCE

| Nature of Ordnance. | | | | Mark of Latest Pattern. | Ordnance. | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Service. | Nominal Weight. | | | Nominal Length. | |
| | | | | | | tons | cwt. | lbs. | ft. | in. |
| Rifled. | Breech-loading Screw | | 7-in. .. .. | .. | L.S. & S.S. | 0 | 82 | 0 | 10 | 0 |
| | | | | .. | L.S. | 0 | 72 | 0 | 9 | 10 |
| | | | 40-pr. .. .. | .. | L.S. & S.S. | 0 | 35 | 0 | 10 | 1 |
| | | | | .. | L.S. & S.S. | 0 | 32 | 0 | 10 | 0 |
| | | | 20-pr. .. .. | .. | L.S. | 0 | 16 | 0 | 8 | 0 |
| | | | | .. | S.S. | 0 | 15 | 0 | 5 | 6·125 |
| | | | | .. | S.S. | 0 | 13 | 0 | 5 | 6·125 |
| | | | 12-pr. .. | .. | L.S. & S.S. | 0 | 8 | 0 | 6 | 0 |
| | | | 9-pr. .. | .. | L.S. & S.S. | 0 | 6 | 0 | 5 | 2 |
| | | | 6-pr. .. | .. | L.S. & S.S. | 0 | 3 | 0 | 5 | 0·125 |
| | Muzzle-loading | Bronze | 7-pr. .. | II. | L.S. & S.S. | 0 | 0 | 200 | 3 | 0 |
| | | Cast-iron* | 80-pr.‡ (68-pr.) | I. | L.S. | 5 | 0 | 0 | 10 | 0 |
| | | | 64-pr.‡ (8-in.) | I. | S.S. | 0 | 71 | 0 | 9 | 0 |
| | | | 64-pr.‡ (32-pr.) | I. | L.S. | 0 | 58 | 0 | 9 | 6 |
| | | Wrought-iron | §§ -in.† .. | I. | S.S. | 80 | 0 | 0 | 26 | 9 |
| | | | 12·5-in. .. | I. | L.S. & S.S. | 38 | 0 | 0 | 18 | 9·5 |
| | | | 12-in. .. .. | I. | L.S. & S.S. | 35 | 0 | 0 | 15 | 11·75 |
| | | | | II. | L.S. & S.S. | 25 | 0 | 0 | 14 | 3·5 |
| | | | 11-in. .. .. | II. | L.S. & S.S. | 25 | 0 | 0 | 14 | 2 |
| | | | 10-in. .. .. ψ | II. | L.S. & S.S. | 18 | 0 | 0 | 14 | 2·75 |
| | | | 9-in. .. .. | V. | L.S. & S.S. | 12 | 0 | 0 | 12 | 3 |
| | | | 8-in. .. .. | III. | S.S. | 9 | 0 | 0 | 11 | 4·5 |
| | | | 7-in. .. .. | III. | L.S. | 7 | 0 | 0 | 11 | 9·5 |
| | | | | III. | S.S. | 6 | 10 | 0 | 10 | 6 |
| | | | | I. | S.S. | 0 | 90 | 0 | 10 | 4·5 |
| | | | 64-pr.‡ .. | III. | L.S. & S.S. | 0 | 64 | 0 | 9 | 3·5 |
| | | | 40-pr. .. .. | I. | L.S. | 0 | 34 | 0 | 8 | 0 |
| | | | 40-pr. .. .. | II. | L.S. | 0 | 35 | 0 | 9 | 6·75 |
| | | | 25-pr. .. .. | I. | L.S. | 0 | 18 | 0 | 7 | 10·5 |
| | | | 16-pr. .. .. | I. | L.S. | 0 | 12 | 0 | 6 | 2·45 |
| | | | 9-pr. .. .. ψ | I & II. | L.S. & S.S. | 0 | 8 | 0 | 5 | 8·5 |
| | | | | I. | S.S. | 0 | 6 | 0 | 4 | 10 |
| | | | | II. | L.S. | 0 | 6 | 0 | 5 | 11 |
| | | Steel | 7-pr. .. .. | III. | L.S. | 0 | 0 | 150 | 2 | 2·5 |
| | | | | IV. | L.S. & S.S. | 0 | 0 | 200 | 3 | 2·9 |
| | | Howitzer, | 6·3-in. .. | I. | L.S. | 0 | 18 | 0 | 4 | 6 |
| | | " | 8-in. .. | I. | L.S. | 0 | 46 | 0 | 5 | 1·125 |
| | | " | 10-in.† .. | I. | L.S. | 6 | 0 | 0 | 6 | 5·5 |
| | | Gatling gun | 0·45 | Nil. | L.S. & S.S. | 0 | 3 | 108 | 4 | 11·41 |
| | | | 0·65† | " | S.S. | 0 | 7 | 35 | 5 | 2·5 |

---

* Has an inner barrel of coiled wrought iron.

‡ Take 32-pr. S.B. ammunition.

† Not yet in the service, but likely to be soon introduced.

§ The length of rifling in B.L. guns includes that in the shot chamber.

AND AMMUNITION.¶

| Ordnance. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Bore. | | | Preponderance. | | | Rifling. | | | |
| Calibre. | Length. | | | | | Grooves, Number. | § Length. | System. | Twist. |
| in. | ft. | in. | cwt. | qrs. | lbs. | | in. | | |
| 7 | 8 | 3·5 | 6 | 3 | 16 | 76 | 83·125 | Polygrooved | U. 1 in 37 cals. |
| 7 | 8 | 1·5 | 7 | 3 | 27 | 76 | 82·875 | „ | „ 1 in 37 „ |
| 4·75 | 8 | 10·375 | 5 | 1 | 19 | 56 | 92·5 | „ | „ 1 in 36¼ „ |
| 4·75 | 8 | 10·375 | 4 | 3 | 0 | 56 | 92·5 | „ | „ 1 in 36¼ „ |
| 3·75 | 7 | 0 | 2 | 0 | 11 | 44 | 71·625 | „ | „ 1 in 38 „ |
| 3·75 | 4 | 6·125 | 1 | 2 | 0 | 44 | 42·75 | „ | „ 1 in 38 „ |
| 3·75 | 4 | 6·125 | 1 | 1 | 24 | 44 | 42·75 | „ | „ 1 in 38 „ |
| 3 | 5 | 1·375 | 1 | 3 | 3 | 38 | 52·5 | „ | „ 1 in 38 „ |
| 3 | 4 | 4·5 | 0 | 2 | 26 | 38 | 45·5 | „ | „ 1 in 38 „ |
| 2·5 | 4 | 5 | 0 | 1 | 27 | 32 | 45·625 | „ | „ 1 in 30 „ |
| 3 | 2 | 8·15 | 0 | 1 | 17 | 3 | 29·15 | French | U. 1 in 20 cals. |
| 6·3 | 9 | 5·25 | 9 | 3 | 4 | 3 | 106·25 | Woolwich | „ 1 in 40 „ |
| 6·3 | 8 | 7·27 | 6 | 1 | 14 | 3 | 96·27 | Plain groove | „ 1 in 40 „ |
| 6·3 | 9 | 0·45 | 6 | 0 | 0 | 3 | 101·45 | „ | „ 1 in 40 „ |
| §§ | 24 | 0 | .. | | | 11 | .. | .. | .. |
| 12·5 | 16 | 6 | Nil. | | | 9 | 170·5 | Woolwich | I. 0 to 1 in 35 cals. |
| 12 | 13 | 6·5 | 1 | 2 | 0 | 9 | 135 | „ | „ 0 to 1 in 35 „ |
| 12 | 12 | 1 | 6 | 0 | 0 | 9 | 127 | „ | „ 1 in 100 to 1 in 50 „ |
| 11 | 12 | 1 | 2 | 0 | 0 | 9 | 119 | „ | „ 0 to 1 in 35 „ |
| 10 | 12 | 1·5 | 1 | 0 | 0 | 7 | 118 | „ | „ 1 in 100 to 1 in 40 „ |
| 9 | 10 | 5 | 3 | 0 | 0 | 6 | 104 | „ | „ 0 to 1 in 45 „ |
| 8 | 9 | 10 | 3 | 3 | 16 | 4 | 99·5 | „ | „ 0 to 1 in 40 „ |
| 7 | 10 | 6 | 2 | 3 | 2 | 3 | 110·5 | „ | U. 1 in 35 cals. |
| 7 | 9 | 3 | 3 | 3 | 0 | 3 | 95·5 | „ | „ 1 in 35 „ |
| 7 | 9 | 3 | 2 | 2 | 5 | 3 | 95·5 | „ | „ 1 in 35 „ |
| 6·3 | 8 | 1·5 | 2 | 2 | 18 | 3 | 90·5 | Plain groove | U. 1 in 40 cals. |
| 4·75 | 7 | 1·5 | 0 | 1 | 0 | 3 | 72·5 | Woolwich | „ 1 in 35 „ |
| 4·75 | 8 | 8·5 | 0 | 0 | 26 | 3 | 90·5 | „ | „ 1 in 35 „ |
| 4 | 7 | 4 | 0 | 0 | 10 | 3 | 78 | „ | „ 1 in 35 „ |
| 3·6 | 5 | 8·4 | 0 | 0 | 10 | 3 | 58·04 | French, modified | „ 1 in 30 „ |
| 3 | 5 | 3·5 | 0 | 0 | 7 | 3 | 59·8 | „ | „ 1 in 30 „ |
| 3 | 4 | 5 | 0 | 1 | 1¼ | 3 | 49·3 | „ | „ 1 in 30 „ |
| 3 | 5 | 6 | 0 | 0 | 10 | 3 | 62·3 | „ | „ 1 in 30 „ |
| 3 | 2 | 0 | 0 | 0 | 3 | 3 | 22 | French | „ 1 in 20 „ |
| 3 | 3 | 0 | 0 | 0 | 5 | 3 | 34 | „ | „ 1 in 20 „ |
| 6·3 | 3 | 9 | Nil. | | | 5 | 37 | .. | „ Not settled. |
| 8 | 4 | 0 | 2 | 0 | 0 | 4 | 35·5 | Woolwich | U. 1 in 16 cals. |
| 10 | 5 | 0 | Nil. | | | 7 | .. | „ | „ 1 in 13 „ |
| 0·45 | 2 | 7·95 | 0 | 1 | 7 | 7 | 28·79 | Henry, 10 barrels | „ 1 in 22 ins. |
| 0·65 | 1 | 9 | .. | | | .. | .. | „ | .. |

---

¶ From the Royal Artillery Institution, Woolwich. §§ Calibre not yet settled.

ψ These guns are not interchangeable, on account of a slight difference in sighting for L.S. and S.S.

### LIST OF SERVICE ORDNAN

| Nature of Ordnance. | | | Angles of Tangent Sights for Permanent Deflection. | | Carriages. | Platforms. | | | | Cha |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Garrison, Wrought-iron, with Hydraulic Buffer, Casemate or Dwarf. | Garrison, Wrought-iron, with Hydraulic Buffer. | | | | |
| | | | | | | Casemate. | Dwarf. | | | Peb |
| | | | | | | | A. | D. | C. | |
| | | | ° | ′ | cwt. | cwt. | cwt. | cwt. | cwt. | lbs. |
| Rifled. Breech-loading Screw | | 7-in. .. .. | 2 | 16 | .. | .. | .. | .. | .. | .. |
| | | | 2 | 16 | .. | .. | .. | .. | .. | .. |
| | | 40-pr. .. .. | 2 | 16 | .. | .. | .. | .. | .. | .. |
| | | | 2 | 16 | .. | .. | .. | .. | .. | .. |
| | | 20-pr. .. .. | 2 | 16 | .. | .. | .. | .. | .. | .. |
| | | | 2 | 16 | .. | .. | .. | .. | .. | .. |
| | | | 2 | 16 | .. | .. | .. | .. | .. | .. |
| | | 12-pr. .. .. | 2 | 16 | .. | .. | .. | .. | .. | .. |
| | | 9-pr. .. .. | 2 | 16 | .. | .. | .. | .. | .. | .. |
| | | 6-pr. .. .. | 2 | 16 | .. | .. | .. | .. | .. | .. |
| Muzzle-loading | Bronze, | 7-pr. .. .. | 3 | 0 | .. | .. | .. | .. | .. | .. |
| | Cast-iron* | 80-pr.‡ (68-pr.) | 0 | 19 | .. | .. | .. | .. | .. | .. |
| | | 64-pr.‡ (8-in.) | 2 | 16 | .. | .. | .. | .. | .. | .. |
| | | 64-pr.‡ (32-pr.) | 2 | 16 | .. | .. | .. | .. | .. | .. |
| | Wrought-iron. | §§ -in.† .. | .. | | .. | .. | .. | .. | .. | .. |
| | | 12·5-in. .. | .. | | 119 | 155 | .. | .. | .. | .. |
| | | 12-in. .. .. | 1 | 25 | 100·25 | .. | .. | .. | .. | 11 |
| | | | 0 | 30 | 67 | 110 | 139·25 | 142F | 137·5 | 8 |
| | | 11-in. .. .. | 2 | 26 | 67 | 110 | 139·25 | 142F | 137·5 | 8 |
| | | 10-in. .. .. ψ | 1 | 10 | I. 51·25, II. 67 | 95·5B | 134·25 | 141 | 140·5 | 7 |
| | | 9-in. .. .. | 0 | 44 | 42·25 | 69·5 | 97 | 103·25 | 110 | 5 |
| | | 8-in. .. .. | 0 | 28 | 42·75 | 60 slide | .. | .. | .. | 3 |
| | | 7-in. .. .. | 3 | 0 | 27·25 | 52¼ | 77 | 80·75 | 80·25 | 3 |
| | | | 3 | 0 | 31·25 | 42 slide | .. | .. | .. | |
| | | | 0 | 44 | 24·25 | 36¼ „ | .. | .. | .. | .. |
| | | 64-pr.‡ .. | 2 | 50 | 33 (siege) | .. | .. | .. | .. | .. |
| | | 40-pr. .. .. | 1 | 20 | 27·75 (siege) | .. | .. | .. | .. | .. |
| | | 40-pr. .. .. | 1 | 20 | 30·75 (siege) | .. | .. | .. | .. | .. |
| | | 25-pr. .. .. | 0 | 53 | 14·75 (field) | .. | .. | .. | .. | .. |
| | | 16-pr. .. .. | 1 | 50 | I. 13·25, II. 12·75 | .. | .. | .. | .. | .. |
| | | 9-pr. .. .. ψ | 1 | 30 | I. 12·25. II. 11 | .. | .. | .. | .. | .. |
| | | | 1 | 30 | .. | .. | .. | .. | .. | .. |
| | | | 1 | 30 | .. | .. | .. | .. | .. | .. |
| | Steel | 7-pr. .. .. | 3 | 0 | 2·73 (mountain) | .. | .. | .. | .. | .. |
| | | | 3 | 0 | 3·12 (mountain) | .. | .. | .. | .. | .. |
| | Howitzer, | 6·3-in. .. | .. | | 31 (siege) | .. | .. | .. | .. | .. |
| | „ | 8-in. .. | Variable. | | 42·75 (siege) | .. | .. | .. | .. | .. |
| | „ | 10-in.† .. | „ | | 63·75 (garrison) | .. | .. | .. | 96 | .. |
| | Gatling gun | 0·45 | Vertical. | | .. | .. | .. | .. | .. | .. |
| | | 0·65† | „ | | .. | .. | .. | .. | .. | .. |

---

* Has an inner barrel of coiled wrought iron. † Not yet in the service, but likely to be soon intr

** *Silk cloth* cartridge. †† R.F.G. may be used to replace F.G. §§ Calibre not yet s

θ *For sea service only.* B Mark II. 106¼. F Approximate.

E *There is also a* 12-lb. charge for exceptional use under certain circumstances with mark III. 64-

AND AMMUNITION—*continued.*

| CHARGE. | | | | | SHELL. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pebble. | R.L.G.‡‡ | | | | Empty. | | | | | Bursting Charge. | |
| Full, or Service. | Battering. | Full, or Service. | Reduced and Saluting. | Exercising or Saluting. | Common. | Double. | Palliser. | Segment. | Shrapnel, Boxer. | Common. | Double. |
| lbs. oz. | lbs. oz. | lbs. oz. | lbs. oz. | lbs. oz. | lbs. oz. | lbs. oz. | lbs. oz. | lbs. oz. | lbs. oz. | lbs. oz. | lbs. oz. |
| .. | .. | 11 0 | .. | 7 0 | 83 0<br>98 0 | .. | .. | 98 9¼ | .. | 6 8<br>7 10 | .. |
| .. | .. | 10 0 | .. | 7 0 | 98 0 | .. | .. | 98 9¼ | .. | 7 10 | .. |
| .. | .. | 5 0 | .. | 3 0 | 37 14 | .. | .. | 38 9¼ | 39 0 | 2 4 | .. |
| .. | .. | 5 0 | .. | 3 0 | 37 14 | .. | .. | 38 9¼ | 39 0 | 2 4 | .. |
| .. | .. | 2 8 | .. | 1 8 | 20 8 | .. | .. | 19 10¼ | .. | 1 2 | .. |
| .. | .. | 2 8 | .. | 1 8 | 20 8 | .. | .. | 19 10¼ | .. | 1 2 | .. |
| .. | .. | 2 8 | .. | 1 8 | 20 8 | .. | .. | 19 10¼ | .. | 1 2 | .. |
| .. | .. | 1 8 | .. | 1 0 | 10 12 | .. | .. | 10 8⅜ | 10 11 | 0 8 | .. |
| .. | .. | 1 2 | : | 1 0 | 8 2½ | .. | .. | 8 3⅜ | 8 11 | 0 6 | .. |
| .. | .. | 0 12 | .. | 0 10 | .. | .. | .. | 5 7 | .. | .. | .. |
| .. | .. | 0 8 F.G. | 0 4FG‖ | | D6 15¾ | 11 2⅜ | .. | .. | 7 8½ | 0 6¼ | 0 15 |
| .. | .. | 10 0 | | **5 0 | 71 1 | .. | .. | .. | 77 6 | 8 13 | .. |
| .. | .. | 8 0 | 6 0 | **5 0 | 56 14 | .. | .. | .. | 66 0 | 7 2 | .. |
| .. | .. | 8 0 | 6 0 | **5 0 | 56 14 | .. | .. | .. | 66 0 | 7 2 | .. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| .. | .. | .. | .. | .. | .. | .. | 790 8 | .. | .. | .. | .. |
| 85 0 | .. | .. | .. | .. | 575 3 | .. | 688 5 | .. | θ610 6 | 40 0 | .. |
| 55 0 | 67 0 | 50 0 | | .. | 459 6 | .. | 586 4 | .. | θ494 13 | 37 12 | .. |
| 60 0 | 70 0 | 50 0 | | .. | 506 4 | .. | 526 4 | .. | θ529 10 | 29 12 | .. |
| 44 0 | 60 0 | 40 0 | | .. | 377 12 | .. | 391 4 | .. | θ403 0 | 20 4 | .. |
| .. | 43 0 | 30 0 | 15 0 | .. | 230 9 | .. | 242 14 | .. | θ254 0 | 19 0 | .. |
| .. | 30 0 | 20 0 | 12 0 | .. | 166 0 | .. | 174 12 | .. | θ179 0 | 14 8 | .. |
| .. | 22 0 | 14 0 | 10 0 | .. | 107 14 | 145 5 | 112 2 | .. | θ115 10 | 8 12 | 10 12 |
| .. | .. | 14 0 | 10 0 | .. | 107 14 | 145 6 | .. | .. | θ115 10 | 8 12 | 10 12 |
| .. | .. | 10 0E | 8 0 | **5 0 | 56 14 | .. | .. | .. | 66 0 | 7 2 | .. |
| .. | .. | 7 0 | .. | .. | 35 9½ | .. | .. | .. | 39 5½ | 2 8 | .. |
| .. | .. | 7 0 | .. | .. | 35 9½ | .. | .. | .. | 39 5½ | 2 8 | .. |
| .. | .. | 4 0 | .. | .. | 23 3½ | .. | .. | .. | 25 0 | 1 12 | .. |
| .. | .. | 3 0 | .. | **1 8 | 15 1 | .. | .. | .. | 17 13 | 1 2 | .. |
| .. | .. | 1 12 | .. | **1 0 | 8 9½ | .. | .. | .. | 9 12 | 0 7½ | .. |
| .. | .. | 1 8 | .. | **1 0 | 8 9½ | .. | .. | .. | 9 12 | 0 7½ | .. |
| .. | .. | 1 12 | .. | **1 0 | 8 9½ | .. | .. | .. | 9 12 | 0 7½ | .. |
| .. | .. | 0 6 | 0 4FG‖ | .. | D6 15¾ | .. | .. | .. | 7 8½ | 0 6¼ | 0 15 |
| .. | .. | ††0 12 F.G. | 0 4FG‖ | .. | D6 15¾ | 11 2⅜ | .. | .. | 7 8½ | 0 6¼ | 0 15 |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| .. | .. | 10lb., 5lb., 2½lb. | .. | .. | 166 0 | .. | .. | .. | .. | 14 8 | .. |
| .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| .. | .. | 85 gr. R.F.G.[2] | .. | .. | .. | .. | .. | .. | .. | .. | .. |
| .. | .. | 270 „ | .. | .. | .. | .. | .. | .. | .. | .. | .. |

Take 32-pr. S.B. ammunition. ‖ For vertical fire with double shell.

‡ L.G. powder to be used with B.L. guns, and in garrison service for all full charges of R.M.L. guns der the 10-in., and in the S.S. with R.M.L. guns up to 80-pr. inclusive (7-pr. excepted).

D Star shell also used, fuze 5 sec., fired with charge not exceeding 4 oz. It is issued filled.

These *guns are not interchangeable*, on account of a slight difference in sighting for L.S. and S.S.

### LIST OF SERVICE ORDNANCE

| NATURE OF ORDNANCE. | | | | SHELL. | | | FUZES. | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Bursting Charge. | | | Percussion. | | |
| | | | | Palliser. | Segment. | Shrapnel, Pistol, F.G. or R.F.G. | R.L. | B.L. Plain. | III Pettman's General Service. |
| | | | | lbs. oz. | lbs. oz. gr. | lbs. oz. | | | |
| RIFLED. | Breech-loading Screw | | 7-in. .. .. | .. | 3 2 0 | .. | C. seg. | .. | C. seg. |
| | | | | .. | 3 2 0 | .. | C. seg. | .. | C. seg. |
| | | | 40-pr. .. .. | .. | 0 13 0 | 0 3 | C. seg. sh. | .. | C. seg. |
| | | | | .. | 0 13 0 | 0 3 | C. seg. sh. | .. | C. seg. |
| | | | 20-pr. .. .. | .. | 0 0 700 | .. | .. | C. seg. | .. |
| | | | | .. | 0 0 700 | .. | .. | Seg. | C. |
| | | | | .. | 0 0 700 | .. | .. | Seg. | C. |
| | | | 12-pr. .. .. | .. | 0 0 550 | 0 0¾ | Sh. | C. seg. | .. |
| | | | 9-pr. .. .. | .. | 0 0 300 | 0 0¾ | Sh. | C. seg. | .. |
| | | | 6-pr. .. .. | .. | 0 0 200 | .. | .. | Seg. | .. |
| | Muzzle-loading | Bronze, | 7-pr. .. .. | .. | .. | 0 0½ | C. sh. | .. | .. |
| | | Cast-iron* | 80-pr.‡ (68-pr.) | .. | .. | 0 9 | C. sh. | .. | C. |
| | | | 64-pr.‡ (8-in. | .. | .. | 0 9 | C. sh. | .. | C. |
| | | | 64-pr.‡ (32-pr.) | .. | .. | 0 9 | C. sh. | .. | C. |
| | | Wrought-iron | §§ -in.† .. | .. | .. | .. | .. | .. | .. |
| | | | 12·5-in. .. | 11 12 | .. | .. | .. | .. | .. |
| | | | 12-in. .. .. | 9 14 | .. | 1 15 | .. | .. | C. |
| | | | | 14 0 | .. | 1 15 | .. | .. | C. |
| | | | 11-in. .. .. | 6 7 | .. | 1 12 | .. | .. | C. |
| | | | 10-in. .. .. ψ | 6 14 | .. | 1 9 | .. | .. | C. |
| | | | 9-in. .. .. | 5 8 | .. | 1 5 | .. | .. | C. |
| | | | 8-in. .. .. | 4 8 | .. | 1 0 | .. | .. | C. |
| | | | 7-in. .. .. | 2 8 | .. | 0 12 | .. | .. | C. D. |
| | | | | .. | .. | .. | .. | .. | .. |
| | | | | .. | .. | 0 12 | .. | .. | C. D. |
| | | | 64-pr.‡ .. | .. | .. | 0 9 | C. sh. | .. | C. |
| | | | 40-pr. .. | .. | .. | 0 5 | C. sh. | .. | C. |
| | | | 40-pr. .. | .. | .. | 0 5 | C. sh. | .. | C. |
| | | | 25-pr. .. | .. | .. | 0 3 | C. sh. | .. | .. |
| | | | 16-pr. .. | .. | .. | 0 1½ | C. sh. | .. | .. |
| | | | 9-pr. .. ψ | .. | .. | 0 0¾ | C. sh. | .. | .. |
| | | | | .. | .. | 0 0¾ | C. sh. | .. | .. |
| | | | | .. | .. | 0 0¾ | C. sh. | .. | .. |
| | | Steel | 7-pr. .. .. | .. | .. | 0 0½ | C. sh. | .. | .. |
| | | | | .. | .. | 0 0½ | C. sh. | .. | .. |
| | | Howitzer, | 6·3-in. .. | .. | .. | .. | .. | .. | .. |
| | | " | 8-in. .. | .. | .. | .. | .. | .. | C. |
| | | " | 10-in.† .. | .. | .. | .. | .. | .. | .. |
| | | Gatling gun | 0·45 | .. | .. | .. | .. | .. | .. |
| | | | 0·65† | .. | .. | .. | .. | .. | .. |

---

* Has an inner barrel of coiled wrought iron.

† Not yet in the service, but likely to be soon introduced.

‡ *Take 32-pr. S.B. ammunition.*

§§ Calibre not yet settled.

ψ *These guns are not interchangeable, on account of the slight difference in sighting for L.S. and S.S*

AND AMMUNITION—*continued.*

| Fuzes. | | | | Shot. | | |
|---|---|---|---|---|---|---|
| Time. | | | | | | |
| Metal. | Wood, Boxer. | | | | | |
| ¶ Armstrong, E. | 20 Seconds. | 9 Seconds. | 5 Seconds. | Case. | Common, Solid. | Palliser. |
| | | | | lbs. oz. | lbs. oz. | lbs. oz. |
| .. | C. seg. | C. seg. | .. | 69 0 | .. | .. |
| .. | C. seg. | C. seg. | .. | 69 0 | .. | .. |
| .. | C. seg. | C. seg. sh. | .. | 31 8 | 40 13¼ | .. |
| .. | C. seg. | C. seg. sh. | .. | 31 8 | 40 13¼ | .. |
| .. | .. | .. | .. | 20 5¼ | 20 9¼ | .. |
| Seg. | C. | C. | .. | 20 5¼ | 20 9¼ | .. |
| Seg. | C. | C. | .. | 20 5¼ | 20 9¼ | .. |
| Seg. | .. | Sh. | Sh. | 11 8 | 11 7 | .. |
| Seg. | .. | Sh. | Sh. | 9 0 | 8 13 | .. |
| Seg. | .. | .. | .. | 5 9 | 6 2 | .. |
| .. | D. | D. C. sh. | Sh. | 6 4 | .. | .. |
| .. | .. | C. sh. | Sh. | 50 8¼ | .. | .. |
| .. | .. | C. sh. | Sh. | 50 8¼ | .. | .. |
| .. | .. | C. sh. | Sh. | 50 8¼ | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |
| .. | .. | θSh. | .. | 246 0 | .. | .. |
| .. | .. | θSh. | .. | 246 0 | .. | φ596 4 |
| .. | .. | θSh. | .. | 200 0 | .. | .. |
| .. | .. | θSh. | .. | 143 0 | .. | φ400 0 |
| .. | .. | θSh. | .. | 107 0 | .. | φ244 12 |
| .. | .. | θSh. | .. | 74 0 | .. | φ176 2 |
| .. | θC. | θC. sh. dble. | .. | 69 0 | .. | φ113 3 |
| .. | .. | .. | .. | .. | .. | .. |
| .. | θC. | θC. sh. dble. | .. | 69 0 | .. | .. |
| .. | .. | C. sh. | Sh. | 50 8¼ | .. | .. |
| .. | .. | C. sh. | Sh. | 38 6 | .. | .. |
| .. | .. | C. sh. | Sh. | 38 6 | .. | .. |
| .. | .. | C. sh. | Sh. | 24 4 | .. | .. |
| .. | .. | C. sh. | Sh. | 15 3 | .. | .. |
| .. | .. | C. sh. | Sh. | 9 13¼ | .. | .. |
| .. | .. | C. sh. | Sh. | 9 13¼ | .. | .. |
| .. | .. | C. sh. | Sh. | 9 13¼ | .. | .. |
| .. | D. | D. C. sh. | Sh. | 6 4 | .. | .. |
| .. | D. | D. C. sh. | Sh. | 6 4 | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |
| .. | C. | C. | .. | 74 0 | .. | .. |
| .. | .. | .. | .. | .. | .. | .. |
| .. | .. | .. | .. | .. | 480 grs. | .. |
| .. | .. | .. | .. | .. | 3 oz. 4 drs. | .. |

¶ This fuze is not used for land service. θ For sea service only.

‖‖ The Pettman's G.S. fuze is issued to sea fronts and S.S. only.

φ May be used as shell, their capacity being 7¼ lbs., 4 lbs., 3¼ lbs., 2 lbs. 10 oz. and 1 lb. 10 oz. respectively. C. Common. D. Double. Seg. Segment. Sh. Shrapnel.

## List of Service Ordnance

| Nature of Ordnance. | | | | Ordnance. | | | |
|---|---|---|---|---|---|---|---|
| | | | | Service. | Weight. | Length. | |
| | | | | | cwt. | ft. | in. |
| Smooth-bore. | Bronze | Guns .. | 12 pr. .. .. | L.S. | 18 | 6 | 6 |
| | | | 9-pr. .. .. | L.S. | 13½ | 5 | 11·4 |
| | | | 6-pr. .. .. | L.S. & S.S. | 6 | 5 | 0 |
| | | | 3-pr. .. .. | L.S. | 3 | 4 | 0 |
| | | | | L.S. | 2¼ | 3 | 0 |
| | | Howitzers | 32-pr. .. .. | L.S. | 17 | 5 | 3 |
| | | | 24-pr. .. .. | L.S. & S.S. | 12½ | 4 | 8·6 |
| | | | 12-pr. .. .. | L.S. & S.S. | 6½ | 3 | 9·2 |
| | | | 4⅖-in. .. .. | L.S. | 2¼ | 1 | 10 |
| | | Mortars .. | 5½-in. royal | L.S. | 1¼ | 1 | 3·1 |
| | | | 4⅖-in. Coehorn | L.S. | ¾ | 1 | 1 |
| | Cast-iron | Carronades | 68-pr. .. .. | L.S. | 36 | 5 | 4 |
| | | | 42-pr. .. .. | L.S. | 22 | 4 | 5 |
| | | | 32-pr. .. .. | L.S. | 17 | 3 | 11·71 |
| | | | 24-pr. .. .. | L.S. | 13 | 3 | 8 |
| | | Guns .. | 68-pr. .. .. | L.S. | 112° * | 10 | 10 |
| | | | | L.S. & S.S. | 95* | 10 | 0 |
| | | | 10-in. .. .. | L.S. & S.S. | 86* | 9 | 4 |
| | | | 8-in. .. .. | L.S. & S.S. | 65† | 9 | 0 |
| | | | | L.S. & S.S. | 60† | 8 | 10 |
| | | | | L.S. & S.S. | 54* | 8 | 0 |
| | | | 42-pr.° .. .. | L.S. | 84§ | 10 | 0 |
| | | | | L.S. | 67* | 9 | 6 |
| | | | 32-pr. .. .. | L.S. | 63† | 9 | 7 |
| | | | | L.S. & S.S. | 58* | 9 | 6 |
| | | | | L.S. & S.S. | 56‡ | 9 | 6 |
| | | | | L.S. & S.S. | 50 A§ | 9 | 0 |
| | | | | L.S. | 48 or 50†‡ D | 8 | 0 |
| | | | | L.S. & S.S. | 45§ | 8 | 6 |
| | | | | L.S. & S.S. | 42§ | 8 | 0 |
| | | | | L.S. | 40∥ E | 7 | 6 |
| | | | | L.S. | 39∥‡ | 7 | 6 |
| | | | | L.S. & S.S. | 32∥‡ | 6 | 6 |
| | | | | L.S. & S.S. | 25* | 6 | 0 |
| | | | 24-pr. .. .. | L.S. | 50‡ | 9 | 6 |
| | | | | L.S. | 48‡ | 9 | 0 |
| | | | | L.S. | 20∥‡ | 6 | 0 |
| | | | 18-pr. .. .. | L.S. | 42‡ | 9 | 0 |
| | | | | L.S. | 38‡ | 8 | 0 |
| | | | 12-pr. .. .. | L.S. | 34‡ | 9 | 0 |
| | | | 9-pr. .. .. | L.S. & S.S. | 28‡ | 8 | 6 |
| | | Howitzers | 10-in. .. .. | L.S. | 42† | 5 | 0 |
| | | | 8-in. .. .. | L.S. | 22† | 4 | 0 |
| | | Mortars .. | 13-in. .. ** | S.S. | 100 | 5 | 4 |
| | | | .. | L.S. & S.S. | 100 | 4 | 5 |
| | | | .. | L.S. | 36† | 3 | 3·65 |
| | | | 10-in. .. .. | S.S. | 52‡ | 3 | 10 |
| | | | | L.S. | 18† | 2 | 5 |
| | | | 8-in. .. .. | L.S. | 9† | 2 | 1·23 |

---

* Dundas'. † Millar's. ‡ Blomefield's. § Monk's. ∥ Bored up.

● The maximum charge to be used when firing carcasses from the 13-inch S.S. mortar is to be 16 lbs., and from the 10-inch gun 8 lbs.

*N.B.*—100-pr. wrought-iron guns are in the service for coastguard and training ships.

AND AMMUNITION—*continued*.

| ORDNANCE. | | | BALLS. | | | CHARGE. | | |
|---|---|---|---|---|---|---|---|---|
| Bore. | | Preponderance. | Light, Ground. | Smoke. | CARCASSES (filled). | Exercising and Saluting. | | Service. |
| Calibre. | Length. | | | | | Serge, L.S. | Silk Cloth, L.S. | |
| in. | ft. in. | cwt. | lbs. oz. | lbs. oz. | lbs. oz. | lbs. oz. | lbs. oz. | lbs. oz. |
| 4·623 | 6 2¼ | 2·3 | .. | .. | 9 8 | 3 0 | .. | 4 0 |
| 4·2 | 5 7·74 | 1·5 | .. | .. | .. | 1 8 | .. | 2 8 |
| 3·668 | 4 9·47 | 0·75 | .. | .. | .. | 1 0 | .. | 1 8 |
| 2·913 | 3 10 | .. | .. | .. | .. | 0 12 | .. | 0 12 |
| 2·913 | 2 10 | .. | .. | .. | .. | 0 10 | .. | 0 10 |
| 6·3 | 5 1¼ | 2·0 | .. | .. | 26 12 | 2 0 | .. | 3 0 |
| 5·72 | 4 7·15 | 1·0 | .. | .. | 19 4 | 1 8 | .. | 2 8 |
| 4·58 | 3 7·8 | 0·5 | .. | .. | 9 8 | 1 0 | .. | 1 4 |
| 4·52 | 1 8·86 | 0·5 | .. | .. | 9 8 | 0 4 | .. | 0 8 |
| 5·62 | 0 11·94 | .. | 10 9½ | 4 8 | 19 4 | .. | .. | 0 7 |
| 4·52 | 0 10¼ | .. | 5 2 | 2 1 | 9 8 | .. | .. | 0 5 |
| 8·05 | 5 2 | 2·3 | .. | .. | 53 0 | .. | .. | 5 0 |
| 6·84 | 4 7 | 1·0 | .. | .. | 30 8 | .. | .. | 3 8 |
| 6·25 | 3 11¾ | 0·5 | .. | .. | 26 12 | .. | .. | 2 11 |
| 5·68 | 3 7¼ | 0·3 | .. | .. | 19 4 | .. | .. | 2 0 |
| 8·12 | 10 3½ | 10·8 | .. | .. | 53 0 | .. | 8 0 | 18 0 |
| 8·12 | 9 5·9 | 10·5 | .. | .. | 53 0 | .. | 8 0 | 16 0 |
| 10·0 | 9 1·33 | 9·0 | .. | .. | 105 0 | .. | 8 0 | 12● 0 |
| 8·05 | 8 9·27 | 8·0 | .. | .. | 53 0 | .. | 6 0 | 10 0 |
| 8·05 | 8 7¼ | 6·2 | .. | .. | 53 0 | .. | 6 0 | 10 0 |
| 8·05 | 7 9¾ | 6·7 | .. | .. | 53 0 | .. | 6 0 | 8 0 |
| 6·97 | 9 6¾ | 9·0 | .. | .. | 30 8 | .. | 6 0 | 14 0 |
| 6·935 | 9 0¾ | 9·0 | .. | .. | 30 8 | .. | 6 0 | 10 8 |
| 6·41 | 9 3 | 5·25 | .. | .. | 26 12 | .. | 5 0 | 10 0 |
| 6·375 | 9 0·65 | 6·0 | .. | .. | 26 12 | .. | 5 0 | 10 0 |
| 6·41 | 8 11·2 | 5·0 | .. | .. | 26 12 | .. | 5 0 | 10 0 |
| 6·375 | 8 7·08 | 7·0 | .. | .. | 26 12 | .. | .. | 8 0 |
| 6·41 | 7 7 | 4·5 | .. | .. | 26 12 | .. | .. | 8 0 |
| 6·35 | 8 1¼ | 6·0 | .. | .. | 26 12 | .. | .. | 7 0 |
| 6·35 | 7 7·2 | 5·7 | .. | .. | 26 12 | .. | .. | 6 0 |
| 6·35 | 7 0¼ | 3·5 | .. | .. | 26 12 | .. | .. | 6 0 |
| 6·375 | 7 1 | 3·5 | .. | .. | 26 12 | .. | .. | 6 0 |
| 6·3 | 6 0¼ | 3·2 | .. | .. | 26 12 | .. | .. | 5 0 |
| 6.3 | 5 7·64 | 3·5 | .. | .. | 26 12 | .. | .. | 4 0 |
| 5·823 | 8 11·41 | 4·5 | .. | .. | 19 4 | .. | 3 0 | 8 0 |
| 5·823 | 8 5½ | 4·5 | .. | .. | 19 4 | .. | 3 0 | 8 0 |
| 5·823 | 5 7¼ | 2·5 | .. | .. | 19 4 | .. | 3 0 | 2 8 |
| 5·292 | 8 5·75 | 3·5 | .. | .. | 14 12 | .. | 3 0 | 6 0 |
| 5·292 | 7 6 | 3·5 | .. | .. | 14 12 | .. | 3 0 | 6 0 |
| 4·623 | 8 6¼ | 3·5 | .. | .. | 9 8 | .. | 2 0 | 4 0 |
| 4·2 | 8 0½ | 2·7 | .. | .. | .. | .. | 1 8 | 3 0 |
| 10·0 | 4 9¼ | 5·0 | .. | .. | 105 0 | .. | .. | 7 0 |
| 8·0 | 3 9¾ | 2·5 | .. | .. | 53 0 | .. | .. | 4 0 |
| 13·0 | 4 1·2 | .. | .. | .. | 234 0 | .. | .. | 20● 0 |
| 13·0 | 3 3 | .. | .. | .. | 234 0 | .. | .. | 20● 0 |
| 13·0 | 2 8·5 | .. | .. | .. | 234 0 | .. | .. | 9 0 |
| 10·0 | 2 11 | .. | 63 10½ | 21 8 | 105 0 | .. | .. | 9 8 |
| 10·0 | 2 1 | .. | 63 10½ | 21 8 | 105 0 | .. | .. | 4 0 |
| 8·0 | 1 8 | .. | 33 0 | 10 12 | 53 0 | .. | .. | 2 0 |

** This mortar *was introduced in 1857*, but exists only as a pattern for future manufacture.

***A*** *Without gear.* **D** Dickson. **E** Congreve gun.

*Those natures marked with* ° are only retained in the service until replaced by rifled guns.

or battalion. Light horse, artillery, engineers, and mounted rifle volunteers will also wear letters denoting the branches of the service to which they respectively belong. The stars to be worn by proficient sergeants will be similar to those worn in the badges for good shooting, but of 1½ inch instead of ½ inch diameter. The star worn by a volunteer who has been five times returned as efficient will be of five points. It is desirable that corps clothed in blue or scarlet should wear white belts, expense pouches white, large pouches black; corps clothed in green, black belts and pouches; and those in grey, black or brown belts and pouches. In the event of changes of uniform, accoutrements will only be authorised in accordance with the preceding paragraph, and any new corps raised, unless forming part of an administrative regiment otherwise accoutred, will strictly conform to the provisions of that paragraph. Officers will wear cross-belts and pouches. The infantry sash will not be worn by officers or sergeants. Neither gold lace nor brass ornaments are to be worn by volunteer corps. The distinctions in uniform and appointments which are prescribed in the regular service and militia to denote the rank of the wearer should be strictly observed by volunteers of the various grades as far as they are applicable to the volunteer force. In this respect the dress regulations for the army are to be taken as a guide. Corps will not adopt any undress without authority. No change whatever (either as regards alteration or addition) will be made without authority obtained from the secretary of state, through the general officer commanding the district."

Some of the regulations enumerated above will take effect in 1876, others again as late as 1879.

### APPOINTMENT OF ADJUTANTS.

The following circular in relation to the appointment of adjutants to volunteer corps has been issued from the War Office:—

"In the event of an adjutancy becoming vacant, either by death or retirement, the commanding officer of the administrative regiment or corps of volunteers in which the vacancy has occurred, if he should have any very special reason for wishing to obtain the services of any particular officer to succeed to the appointment, will make his application through the proper channel to the adjutant-general. In the case of a retirement, the application will not be made until the retirement shall have been notified in the *London Gazette*. The commanding officer will state, in his application, the exceptional qualification which, in his opinion, renders it desirable that the officer referred to should be appointed in preference to any other candidate who may in other respects be equally eligible. The secretary of state disapproves commanding officers of volunteers communicating direct with commanding or other officers of the army, with a view of finding suitable candidates. They should clearly understand that the selection of officers for appointment as adjutants does not rest with commanding officers of volunteers, who should not make any recommendation on the subject, except under the special circumstances above detailed."

# APPENDIX B.

TABLE SHOWING THE ENERGY OF PROJECTILES FIRED WITH BATTERING CHARGES OF PEBBLE POWDER FROM HEAVY RIFLED MUZZLE-LOADING GUNS.

| Range. | 12-inch R.M.L. of 35 tons. Charge, 110 lbs. Projectile, 700 lbs. | | | 12-inch R.M.L. of 25 tons. Charge, 85 lbs. Projectile, 600 lbs. | | | 11-inch R.M.L. of 25 tons. Charge, 85 lbs. Projectile, 535 lbs. | | | 10-inch R.M.L. of 18 tons. Charge, 70 lbs. Projectile, 400 lbs. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | v. | Total Energy. | Energy per Inch of Shot's Circumference. | v. | Total Energy. | Energy per Inch of Shot's Circumference. | v. | Total Energy. | Energy per Inch of Shot's Circumference. | v. | Total Energy. | Energy per Inch of Shot's Circumference. |
| yds. | ft. | ft. tons | ft. tons | ft. | ft. tons | ft. tons | ft. | ft. tons | ft. tons | ft. | ft. tons | ft. tons |
| 0 | 1300 | 8200 | 219 | 1300 | 7030 | 188 | 1315 | 6415 | 187 | 1364 | 5160 | 165·6 |
| 200 | 1277 | 7915 | 211 | 1273 | 6750 | 181 | 1289 | 6165 | 180 | 1336 | 4950 | 158·9 |
| 400 | 1255 | 7645 | 204 | 1248 | 6480 | 174 | 1265 | 5935 | 173 | 1308 | 4745 | 152·3 |
| 600 | 1234 | 7391 | 197 | 1224 | 6230 | 167 | 1242 | 5720 | 167 | 1280 | 4575 | 146·8 |
| 800 | 1215 | 7165 | 191 | 1201 | 6000 | 161 | 1220 | 5520 | 161 | 1254 | 4360 | 140·0 |
| 1000 | 1196 | 6946 | 185 | 1179 | 5780 | 155 | 1199 | 5335 | 156 | 1228 | 4185 | 134·2 |
| 1200 | 1178 | 6735 | 180 | 1157 | 5570 | 149 | 1179 | 5155 | 150 | 1204 | 4020 | 129·0 |
| 1400 | 1160 | 6531 | 175 | 1137 | 5380 | 144 | 1159 | 4985 | 145 | 1181 | 3870 | 124·1 |
| 1600 | 1143 | 6341 | 170 | 1118 | 5200 | 139 | 1139 | 4815 | 140 | 1159 | 3725 | 120·0 |
| 1800 | 1126 | 6154 | 165 | 1101 | 5040 | 135 | 1122 | 4670 | 136 | 1133 | 3590 | 115·3 |
| 2000 | 1109 | 5971 | 160 | 1085 | 4890 | 131 | 1106 | 4540 | 132 | 1118 | 3470 | 111·2 |
| 2200 | 1093 | 5799 | 155 | 1069 | 4750 | 127 | 1090 | 4410 | 129 | 1099 | 3350 | 107·5 |
| 2400 | 1077 | 5630 | 150 | 1055 | 4630 | 124 | 1075 | 4285 | 125 | 1082 | 3245 | 104·2 |
| 2600 | 1062 | 5474 | 146 | 1041 | 4510 | 120 | 1061 | 4175 | 122 | 1066 | 3150 | 101·1 |
| 2800 | 1047 | 5322 | 142 | 1028 | 4400 | 117 | 1048 | 4075 | 119 | 1052 | 3070 | 98·5 |
| 3000 | 1032 | 5169 | 138 | 1016 | 4300 | 115 | 1036 | 3980 | 116 | 1038 | 2990 | 95·9 |
| 3200 | 1018 | 5030 | 134 | 1004 | 4200 | 112 | 1024 | 3890 | 113 | 1025 | 2915 | 93·5 |
| 3400 | 1004 | 4892 | 130 | 993 | 4100 | 110 | 1012 | 3800 | 111 | 1013 | 2845 | 91·3 |
| 3600 | 991 | 4766 | 127 | 984 | 4030 | 108 | 1002 | 3725 | 109 | 1002 | 2785 | 89·4 |
| 3800 | 978 | 4642 | 124 | 976 | 3960 | 106 | 994 | 3665 | 107 | 992 | 2730 | 87·6 |
| 4000 | 966 | 4529 | 121 | 968 | 3900 | 104 | 986 | 3605 | 105 | 982 | 2675 | 85·8 |

TABLE SHOWING THE ENERGY OF PROJECTILES FIRED WITH BATTERING CHARGES OF PEBBLE POWDER FROM HEAVY RIFLED MUZZLE-LOADING GUNS—*continued.*

| Range. | 9-inch R.M.L. of 12 tons.<br>Charge, 50 lbs.<br>Projectile, 250 lbs. | | | 8-inch R.M.L. of 9 tons.<br>Charge, 35 lbs.<br>Projectile, 180 lbs. | | | 7-inch R.M.L. of 6½ tons.*<br>Charge, 30 lbs.<br>Projectile, 115 lbs. | | |
|---|---|---|---|---|---|---|---|---|---|
| | *v.* | Total Energy. | Energy per Inch of Shot's Circumference. | *v.* | Total Energy. | Energy per Inch of Shot's Circumference. | *v.* | Total Energy. | Energy per Inch of Shot's Circumference. |
| yds. | ft. | ft. tons | ft. tons | ft. | ft. tons | ft. tons | ft. | ft. tons | ft. tons |
| 0 | 1420 | 3496 | 124·7 | 1413 | 2492 | 100·2 | 1525 | 1855 | 85·3 |
| 200 | 1379 | 3297 | 117·6 | 1369 | 2339 | 94·0 | 1467 | 1716 | 78·9 |
| 400 | 1341 | 3117 | 111·2 | 1327 | 2198 | 88·3 | 1409 | 1583 | 72·8 |
| 600 | 1304 | 2948 | 105·2 | 1286 | 2064 | 83·0 | 1356 | 1466 | 67·5 |
| 800 | 1270 | 2796 | 99·8 | 1248 | 1944 | 78·1 | 1307 | 1362 | 62·7 |
| 1000 | 1236 | 2648 | 94·5 | 1213 | 1837 | 73·8 | 1261 | 1268 | 58·3 |
| 1200 | 1204 | 2513 | 89·7 | 1180 | 1738 | 69·9 | 1217 | 1181 | 54·3 |
| 1400 | 1174 | 2389 | 85·3 | 1150 | 1651 | 66·3 | 1177 | 1105 | 50·8 |
| 1600 | 1147 | 2281 | 81·4 | 1122 | 1571 | 63·2 | 1141 | 1038 | 47·8 |
| 1800 | 1121 | 2178 | 77·7 | 1097 | 1502 | 60·4 | 1108 | 979 | 45·0 |
| 2000 | 1097 | 2086 | 74·4 | 1074 | 1440 | 57·9 | 1078 | 927 | 42·6 |
| 2200 | 1075 | 2003 | 71·5 | 1052 | 1381 | 55·5 | 1053 | 884 | 40·7 |
| 2400 | 1055 | 1930 | 68·9 | 1032 | 1329 | 53·4 | 1030 | 846 | 38·9 |
| 2600 | 1037 | 1864 | 66·5 | 1014 | 1283 | 51·6 | 1009 | 812 | 37·3 |
| 2800 | 1020 | 1804 | 64·4 | 996 | 1238 | 49·8 | 990 | 782 | 36·0 |
| 3000 | 1004 | 1747 | 62·4 | 980 | 1199 | 48·2 | 973 | 755 | 34·7 |
| 3200 | 990 | 1699 | 60·6 | 965 | 1162 | 46·7 | 958 | 732 | 33·7 |
| 3400 | 978 | 1658 | 59·2 | 952 | 1131 | 45·5 | 945 | 712 | 32·8 |
| 3600 | 966 | 1618 | 57·7 | 940 | 1103 | 44·3 | 934 | 696 | 32·0 |
| 3800 | 955 | 1581 | 56·4 | 930 | 1080 | 43·4 | 924 | 681 | 31·3 |
| 4000 | 945 | 1548 | 55·2 | 920 | 1056 | 42·5 | 916 | 669 | 30·8 |

* The energy per inch of the shot's circumference of projectiles fired from the 7-inch R.M.L. of 7 tons is about 5 per cent. more than the above figures.

TABLE OF

| Name of Fuze. | Length of Composition. Inches. | Time of Burning. Seconds. | Shells used with |
|---|---|---|---|
| | | | R.M.L. |
| 5-second M.L. .. .. .. | 2<br>Mealed powder | 5 | Shrapnel up to 80-pr. inclusive, and 7-pr. star shell .. .. |
| 9 „ „ .. .. .. | 2 | 10 | All Shrapnel shell, common shell up to 80-pr. inclusive, and 7-pr. double shell, also 7-in. common and double, S.S. .. .. |
| 20 „ „ .. .. .. | 4 | 20 | 7-pr. double shell, and 7-inch common, S.S. .. .. .. |
| Pettman's gen. service percussion | .. | .. | Common from 40-pr. upwards, and 7-inch double shell .. |
| R.L. percussion .. .. .. | .. | .. | Common and Shrapnel up to 80-pr. inclusive .. .. .. |
| | | | R.B.L. |
| 5-second B.L. .. .. .. | 2<br>Mealed powder | 5 | Shrapnel for 12- and 9-pr. .. |
| 9 „ „ .. .. .. | 2 | 10 | Common, segment, or Shrapnel for 7-inch 64- and 40-pr.; common for 20-pr. S.S.; Shrapnel for 12- and 9-pr. .. .. |
| 20 „ „ .. .. .. | 4 | 20 | 7-inch, 64- and 40-pr. segment and common, and 20 pr. S.S. common .. .. .. .. |
| Pettman's gen. service percussion | .. | .. | Common or segment for 7-inch, 64- and 40-pr., and 20-pr. S.S. common .. .. .. |
| R.L. percussion .. .. .. | .. | .. | Common, 7-inch, 64- and 40-pr. segment, 7-inch and 40-pr. Shrapnel, 64-, 40-, 12- and 9-pr. |
| B.L. plain percussion .. .. | .. | .. | Common or segment for 20-, 12-, 9- and 6-pr. .. .. .. |
| | | | S.B. |
| Time, diaphragm, Shrapnel .. | 1 | 5 | All diaphragm .. .. .. |
| Time, common .. .. .. | 2 | 10 | All S.B. common § .. .. |
| 9-second M.L. .. .. .. | 2 | 10 | Naval .. .. .. .. |
| 20 „ „ .. .. .. | 4 | 20 | Do. .. .. .. .. .. |
| Mortar, large .. .. .. | 6 | 30 | 13-, 10- and 8-inch mortar shells |
| „ small ‡ .. .. .. | 5 | 15 | 24- and 12-pr. common, when fired from 5½- and 4⅖-inch mortars, at times of flight over 7 seconds with 5½- and 10 seconds with 4⅖-inch .. .. .. |
| Pettman's land service percussion | .. | .. | All S.B. shells having a × on the plug .. .. .. |
| „ general service „ | .. | .. | Naval .. .. .. .. |

---

* *In hundreds of yards in each case. These rules are not in every case suitable for very short ranges.*

† *The numbers on all fuzes, excepting mortar and 5-second fuzes for R.O., denote ½-seconds; in the mortar fuzes, if the figures be multiplied by 10, the same remark will apply; in the 5-second fuzes the whole number denote ½-seconds, the decimals ½-seconds.*

‡ *This fuze must be packed when used with the 4⅖-inch shell.*

§ *Including 24- and 12-pr. common shells, when fired from the bronze mortars, and the time of flight does not exceed 10 seconds.*

SERVICE FUZES.

| Gauge of Fuze-hole. | Other Natures that the Fuze can be used with on an Emergency. | Approximate Rules for obtaining Length of Fuze in ½-seconds for a given Range.† | REMARKS. |
|---|---|---|---|
| **ORDNANCE.** | | | |
| General service | All M.L. shells of G.S. gauge, when time of flight does not exceed 5 seconds .. | Divide range by 2,* and if over 1000, add 1. | Painted red. M.L. TIME FUZES ARE NOT AT PRESENT USED WITH COMMON SHELL FIRED FROM WOOLWICH GUNS OF 7 IN. AND UPWARDS, IN THE L.S. \|\| |
| Do. | Do., do., 9 seconds .. .. | Divide range by 2,* and add—<br>Up to 1000 .. 1<br>1000 to 2000 .. 2<br>2000 to 3000 .. 3 | |
| Do. | Do., except Shrapnel .. | | |
| Do. | .. .. | .. .. | The R.L. percussion fuze mark II. is suited for all B.L. guns and all R.M.L. guns up to the 80-pr. The mark I. is suited to the 7- and 9-pr. R.M.L. only. |
| Do. | .. .. | .. .. | |
| **ORDNANCE.** | | | |
| General service | All shells of G.S. gauge, when time of flight does not exceed 5 seconds .. .. | Divide range by 2,* and if over 1000, add 1 .. .. | Painted red. |
| Do. | Do., do., 9 seconds .. .. | Divide range by 2,* and add—<br>Up to 1000 .. 1<br>1000 to 2000 .. 2<br>2000 to 3000 .. 3 | |
| Do. | Do., except Shrapnel .. | | |
| Do. | | | |
| Field service | | | |
| **ORDNANCE.** | | | |
| Common .. | Any S.B. common shell, if time of flight does not exceed 5 seconds .. .. | Subtract 8 from the range.* | |
| Do. | .. .. | Subtract 5 from the range.* | |
| General service | .. .. | Do. | |
| Do. | 24- and 12-pr. common shell, when fired from bronze mortars and time of flight exceeds 10 seconds. | | |
| Mortar .. | .. .. | Add 17 to range* .. | For ranges below 750 yards, double the range plus 10. |
| Common .. | Any S.B. common shell .. | Add 14 to range.* | |
| Do. | | | |
| General service | | | |

|| Mark I. M.L. *fuze is not to* be used with field guns, as the priming does not always ignite with *small charges.*

*N.B.—All the rifled ordnance time fuzes can be used as percussion, against earthworks, ships,*
*Gun-cotton priming should be used with fuzes for high-angle firing when small charges are*
*It should be remembered that "common" and "naval" shell, for S.B. ordnance, are*
*projectiles.*

# APPENDIX C.

## TABLE SHOWING APPROXIMATELY THE MILITARY RESOURCES OF THE POWERS OF EUROPE.

| Country. | Population. | Military Expenditure. | Army. Peace Footing. | | | Total. | Army. War Footing. | | | Total. | Guns. | Horses. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Infantry. | Cavalry. | Artillery and other Arms. | | Active Army. | Depot Troops. | Garrison and Reserves. | | | |
| | | £ | | | | | | | | | | |
| Austria and Hungary | 35,904,435 | 10,400,000 | 169,931 | 43,993 | 70,511 | 284,435 | 785,649 | 351,752 | | 1,137,401 | 1,632 | 172,981 |
| Belgium .. | 5,253,821 | 1,700,000 | 74,000 | 8,438 | 21,351 | 103,893* | .. | .. | .. | 103,893 | 240 | 15,990 |
| Denmark .. | 1,784,741 | 481,000 | 27,480 | 2,248 | 7,340 | 37,068 | 15,604 | .. | .. | 52,672 | 96 | 9,800 |
| England .. | 31,628,338 | 20,000,000 | 125,433 | 17,275 | 49,830 | 192,538† | 223,538 | 323,448‡ | | 546,986 | 1,402§ | 46,487 |
| France .. | 36,102,921 | 24,519,433 | 281,601 | 68,617 | 140,104 | 490,322 | 930,000 | 240,000 | 580,000 | 1,750,000 | 1,796 | 120,894 |
| Germany .. | 41,060,846 | 17,600,000 | 284,396 | 67,855 | 66,622 | 418,872 | 704,904 | 247,521 | 363,209 | 1,315,634‖ | 2,472 | 301,536 |
| Greece .. | 1,457,894 | 318,200 | 10,351 | 340 | 3,372 | 14,063 | .. | .. | .. | 14,063 | 50 | 720 |
| Holland .. | 3,674,402 | 1,542,000 | 44,812 | 4,509 | 12,751 | 62,072 | .. | .. | .. | 62,072¶ | 108 | 10,000 |
| Italy .. | 26,796,253 | 8,122,000 | 119,303 | 41,143 | 57,503 | 217,949 | 409,426 | 181,195 | 277,265 | 867,886** | 1,240 | 82,153 |
| Portugal .. | 3,995,152 | 773,573 | 27,832 | 4,662 | 6,464 | 38,958 | 73,145 | .. | .. | 73,145†† | 126 | 7,062 |
| Russia .. | 63,658,934‡‡ | 29,199,000 | 535,152 | 73,892 | 234,380 | 886,424 | 808,670 | 242,500 | 469,900 | 1,521,070§§ | 2,798 | 213,200 |
| Spain .. | 16,301,851 | 9,000,000 | 56,000 | 10,900 | 24,500 | 91,400 | 216,000 | .. | .. | 216,000 | 835 | 30,000 |
| Sweden and Norway | 6,103,872 | 726,000 | 37,228 | 5,254 | 5,164 | 47,646 | 112,818 | 26,229 | 29,026 | 268,773 | 322 | 20,700 |
| Switzerland | 2,669,147 | 364,374 | 82,786 | 3,492 | 19,824 | 106,102 | 106,102 | 97,636 | .. | 203,192 | 294 | — |
| Turkey .. | 35,350,000‖‖ | 4,233,000 | 100,800 | 17,280 | 30,600 | 148,680 | 170,376 | 75,000 | 236,600 | 468,976 | — | — |

* Without counting officers.

† Of which there are 62,849 serving in India (*vide* Appendix E).

‡ Auxiliary forces (yeomanry, militia, and volunteers).

§ Of which 693 are field guns.

‖ To this total must be added 25,975 men belonging to the administrative departments.

¶ With 32,145 men doing duty in India.

** To this total must be added 2374 men belonging to the administrative departments.

†† To which must be added 7845 men serving in the colonies.

‡‡ In Europe alone.

§§ Exclusive of 225,756 Caucasian troops and 35,350 Asiatic troops.

‖‖ Including Turkey in Asia and Africa.

# APPENDIX D.

# APPENDIX C.

## TABLE SHOWING APPROXIMATELY THE MILITARY RESOURCES OF THE POWERS OF EUROPE.

| Country. | Population. | Military Expenditure. | Army. Peace Footing. | | | Total. | Army. War Footing. | | | Total. | Guns. | Horses. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Infantry. | Cavalry. | Artillery and other Arms. | | Active Army. | Depot Troops. | Garrison and Reserves. | | | |
| | | £ | | | | | | | | | | |
| Austria and Hungary | 35,904,435 | 10,400,000 | 169,931 | 43,993 | 70,511 | 284,435 | 785,649 | 351,752 | | 1,137,401 | 1,632 | 172,981 |
| Belgium .. | 5,253,821 | 1,700,000 | 74,000 | 8,438 | 21,351 | 103,893* | .. | .. | .. | 103,893 | 240 | 15,990 |
| Denmark .. | 1,784,741 | 481,000 | 27,480 | 2,248 | 7,340 | 37,068 | 15,604 | .. | .. | 52,672 | 96 | 9,800 |
| England .. | 31,628,338 | 20,000,000 | 125,433 | 17,275 | 49,830 | 192,538† | 223,538 | 323,448‡ | | 546,986 | 1,402§ | 46,487 |
| France .. | 36,102,921 | 24,519,433 | 281,601 | 68,617 | 140,104 | 490,322 | 930,000 | 240,000 | 580,000 | 1,750,000 | 1,796 | 120,894 |
| Germany .. | 41,060,846 | 17,600,000 | 284,396 | 67,855 | 66,622 | 418,872 | 704,904 | 247,521 | 363,209 | 1,315,634‖ | 2,472 | 301,536 |
| Greece .. | 1,457,894 | 318,200 | 10,351 | 340 | 3,372 | 14,063 | .. | .. | .. | 14,063 | 50 | 720 |
| Holland .. | 3,674,402 | 1,542,000 | 44,812 | 4,509 | 12,751 | 62,072 | .. | .. | .. | 62,072¶ | 108 | 10,000 |
| Italy .. | 26,796,253 | 8,122,000 | 119,303 | 41,143 | 57,503 | 217,949 | 409,426 | 181,195 | 277,265 | 867,886** | 1,240 | 82,153 |
| Portugal .. | 3,995,152 | 773,573 | 27,832 | 4,662 | 6,464 | 38,958 | 73,145 | .. | .. | 73,145†† | 126 | 7,062 |
| Russia .. | 63,658,934‡‡ | 29,199,000 | 535,152 | 73,892 | 234,380 | 886,424 | 808,670 | 242,500 | 469,900 | 1,521,070§§ | 2,798 | 213,200 |
| Spain .. | 16,301,851 | 9,000,000 | 56,000 | 10,900 | 24,500 | 91,400 | 216,000 | .. | .. | 216,000 | 835 | 30,000 |
| Sweden and Norway | 6,103,872 | 726,000 | 37,228 | 5,254 | 5,164 | 47,646 | 112,818 | 26,229 | 29,026 | 268,773 | 322 | 20,700 |
| Switzerland | 2,669,147 | 364,374 | 82,786 | 3,492 | 19,824 | 106,102 | 106,102 | 97,036 | .. | 203,192 | 294 | — |
| Turkey .. | 35,350,000‖‖ | 4,233,000 | 100,800 | 17,280 | 30,600 | 148,680 | 170,376 | 75,000 | 236,600 | 468,976 | — | — |

* Without counting officers.

† Of which there are 62,849 serving in India (*vide* Appendix E).

‡ Auxiliary forces (yeomanry, militia, and volunteers).

§ Of which 693 are field guns.

‖ To this total must be added 25,975 men belonging to the administrative departments.

¶ With 32,145 men doing duty in India.

** To this total must be added 2374 men belonging to the administrative departments.

†† To which must be added 7845 men serving in the colonies.

‡‡ In Europe alone.

§§ Exclusive of 225,756 Caucasian troops and 35,350 Asiatic troops.

‖‖ Including Turkey in Asia and Africa.

# APPENDIX D.

## TABLE SHOWING THE STRENGTH OF COLUMNS

| PLACE AND DATE. | Number of Columns. | Covering Party. | Engineers with Tools. | Ladder Party. | | | Storming | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Advance. | |
| | | | | Number of Ladders. | Engineers. | Infantry. | Engineers. | Infantry. |
| Bergen-op-Zoom, Sept. 16, 1747 | .. | 600 | .. | .. | .. | .. | .. | 400 |
| Schweidnitz, Sept. 30, 1761 .. | 4 | each of | 62 | 25 | .. | 140 | .. | 3200 |
| Badajoz (Fort Picurina), 10 P.M. March 25, 1812 .. .. .. | 1 | .. | 12 | Yes. | 12 | .. | .. | .. |
| | 2 | .. | 12 | Yes. | 12 | .. | .. | 100 |
| | 3 | .. | .. | Yes. | Yes. | .. | .. | .. |
| Badajoz—the castle .. .. | 1 | .. | 18 | 20 | .. | .. | .. | .. |
| La Trinidad Bastion .. .. .. | 2 | Yes. | 22 | 12 | .. | .. | .. | 500 |
| Sta. Maria Bastion .. .. .. | 3 | 100 | 22 | 12 | .. | .. | .. | 500 |
| St. Roque .. .. .. .. .. .. | 4 | 200 | .. | .. | .. | .. | .. | 200 |
| St. Vicente, 10 P.M. April 6, 1812 | 5 | .. | .. | 12 | .. | .. | .. | .. |
| Burgos (St. Michael's Horn-work), 8 P.M., Sept. 19, 1812 | 1 | 150 | .. | Yes. | .. | Yes. | .. | .. |
| | 2 | | .. | Yes. | .. | .. | .. | .. |
| | 3 | | .. | Yes. | .. | .. | .. | .. |
| Burgos, Sept. 22, 1812 .. .. | 1 | 200 | .. | 6 | .. | 30 | .. | 20 |
| | 2 | .. | .. | 6 | .. | .. | .. | .. |
| Sebastopol, June 18, 1855.. .. | 1 | 100 | 12 | 20 | .. | 120 | .. | 400 |
| | 2 | 100 | 12 | 20 | .. | 120 | .. | 400 |
| | 3 | 100 | 12 | 20 | .. | 120 | .. | 400 |
| | 4 | .. | 106 | Yes. | .. | 1 batt. | .. | 4500 |
| | 5 | .. | 64 | .. | .. | .. | .. | 8000 |
| | 6 | .. | 82 | .. | .. | .. | .. | 5700 |
| Sebastopol, Sept. 8, 1855 .. .. | 1 | 200 | .. | 40 | 21 | 320 | .. | 1000 |
| | 2 | .. | 60 | Yes. | 30 | 180 | 60 | 5000 |
| | 3 | .. | 90 | .. | .. | .. | 60 | 4500 |
| | 4 | .. | .. | .. | .. | .. | .. | 4800 |

---

* From 'Instructions in Military Engineering,' Chatham, 1870.
These cases have not been selected owing to their being the best examples, but simply

## OF ASSAULT, ETC. IN CERTAIN INSTANCES.*

| Party. | | | Working Party. | | Remarks. |
|---|---|---|---|---|---|
| Main Body or Supports. | | | | | |
| Infantry. | Artillery. | Reserve. | Engineers. | Infantry. | |
| 6 batts. | 20 | .. | 24 | 300 | Succeeded; the garrison was 900. |
| .. | .. | 2600 | .. | .. | Succeeded, with a loss of about 1400 men; garrison was 3200 strong. |
| 200<br>100<br>100 | ..<br>..<br>.. | 3 batts. | .. | Yes. | Successful, with loss to English of 19 officers and 300 men killed and wounded. The French garrison mustered nearly 300 men, of whom 3 officers and men were taken prisoners. |
| 3rd div. | 20 | .. | .. | .. | Though only 3 ladders were placed, the escalade succeeded, owing to the number of men employed.<br>A false attack also made on the *tête-de-pont*. The French garrison consisted of 157 officers and 3921 men. The English captured the place, with loss of 317 officers and 3344 men. |
| Rest, 4th div.<br>Rest, lt. div. | 20<br>20 | 1000<br>1000 | ..<br>.. | ..<br>.. | Repulsed at breach. The advance carried sacks of hay. |
| .. | .. | .. | .. | .. | |
| 5th div. | .. | .. | .. | .. | Escalade succeeded; escarp was 31½ feet. |
| .. | .. | .. | .. | .. | Ladders raised; troops would not assault.<br>English captured the hornwork with loss of 21 officers and 399 men. The French lost 6 officers and 137 men. |
| .. | .. | .. | .. | .. | Unsuccessful; troops opened fire at 120 yards while advancing to assault. |
| .. | .. | .. | .. | .. | Successful. |
| 180 | .. | .. | .. | Yes. | Repulsed.<br>Failed miserably, owing to the mode of formation of the assaulting columns; too few men employed, and they were composed of detachments. |
| 1 batt. | .. | .. | .. | .. | Checked at once. |
| 800<br>800<br>800 | ..<br>..<br>.. | ..<br>..<br>.. | 16<br>16<br>16 | 400<br>400<br>400 | These were the English columns; 50 men with wool bags accompanied each ladder party. The assault failed. |
| ..<br>1400<br>.. | .. | 10,000 | .. | .. | These were the French columns. The assault failed. |
| 1500 | 20 | 3000 | .. | 200 | English column; the 3rd div. as a further reserve; the escalade was successful, but the reserves were not brought up, and the troops were driven out again. |
| 4500<br>4000<br>4800 | Yes.<br>Yes.<br>Yes. | 18,000 | 30<br>..<br>.. | 80<br>..<br>.. | These were the French columns; the Malakoff was taken, and Sebastopol fell. |

---

. because the *known details respecting* them are more ample than in most other cases.

# APPENDIX E.

## I.—TABLE SHOWING THE STRENGTH OF THE BRITISH ARMY.

*Estimates* 1876–77.

| A. REGULAR ARMY. | Officers. | Men. | Total. | Horses. |
|---|---|---|---|---|
| 1. *General Staff* .. .. .. .. .. | 91 | 90 | 181 | — |
| 2. *Cavalry* :— | | | | |
| Guards, 3 regiments .. .. .. .. | 81 | 1,221 | 1,302 | 825 |
| Line, 28 regiments .. .. .. .. | 792 | 15,181 | 15,973 | 10,781 |
| 2. *Cavalry* .. .. .. .. .. | 873 | 16,402 | 17,275 * | 11,606 |
| 3. *Artillery* :— | | | | |
| Horse artillery, 6 brigades .. .. .. | 229 | 5,179 | 5,408 | 4,308 |
| Riding establishment .. .. .. | 7 | 218 | 225 | 144 |
| Field artillery, 12 brigades .. .. .. | 576 | 11,271 | 11,847 | 18,474 |
| Garrison artillery, 13 brigades .. .. .. | 491 | 13,319 | 13,810 | — |
| Coast artillery, 1 brigade .. .. .. .. | 26 | 1,159 | 1,185 | — |
| Depot brigade {2 batteries of horse artillery ..<br>3 batteries of field artillery ..<br>7 batteries of garrison artillery} | 49 | 1,897 | 1,946 | 438 |
| District staff .. .. .. .. .. | 71 | 428 | 499 | — |
| 3. *Artillery* .. .. .. .. .. | 1,449 | 33,471 | 34,920 † | 13,364 |
| 4. *Engineers* :— | | | | |
| Sappers and miners, 40 companies .. .. | 821 | 4,167 | 4,988 | — |
| Train, 3 troops .. .. .. .. .. | 3 | 719 | 722 | 422 |
| 4. *Engineers* .. .. .. .. .. | 824 | 4,886 | 5,710 ‡ | 422 |
| 5. *Infantry* :— | | | | |
| Guards, 7 battalions .. .. .. .. | 240 | 5,710 | 5,950 | — |
| Line, 134 battalions .. .. .. .. | 3,768 | 99,628 | 103,396 | — |
| Rifles, 8 battalions .. .. .. .. | 224 | 6,000 | 6,224 | — |
| Brigade depots .. .. .. .. .. | 892 | 8,970 | 9,862 | — |
| 5. *Infantry* .. .. .. .. .. | 5,124 | 120,309 | 125,432 § | — |
| 6. *Civil Departments* :— | | | | |
| Army service corps .. {12 transport companies<br>11 supply companies ..} | 8 | 3,006 | 3,014 | 1,095 |
| Army hospital corps .. .. .. .. | 24 | 1,550 | 1,574 | — |
| Paymasters .. .. .. .. .. .. .. | 201 | .. | 201 | — |
| Chaplains .. .. .. .. .. .. .. | 78 | .. | 78 | — |
| Surgeons .. .. .. .. .. .. .. | 561 | .. | 561 | — |
| Commissariat and ordnance store departments | 448 | .. | 448 | — |
| Miscellaneous .. .. .. .. .. | 112 | 550 | 662 | — |
| 6. *Civil Departments* .. .. .. | 1,432 | 5,106 | 6,538 | 1,095 |

* Including 4,330 serving in India.
† " 12,233 " "
‡ " 436 " "
§ " 45,851 " "

Total, 62,849 all ranks of the regular army serving in India.

## TABLE SHOWING THE STRENGTH OF THE BRITISH ARMY—*continued.*

*Estimates* 1876–77.

| | Officers. | Men. | Total. | Horses. |
|---|---|---|---|---|
| 7. *Colonial Corps* :— | | | | |
| West India regiments (2) .. .. .. .. | 102 | 1,730 | 1,832 | — |
| Royal Malta Fencible Artillery .. .. .. | 22 | 349 | 371 | — |
| Lascars (Hong-Kong and Ceylon) .. .. .. | .. | 278 | 278 | — |
| 7. *Colonial Corps* .. .. .. .. | 124 | 2,357 | 2,481 | — |
| 8. *Reserve of the Regular Army* (including enrolled pensioners):— | | | | |
| Class I. .. .. .. .. .. .. | .. | 10,000 | 10,000 | — |
| Class II. .. .. .. .. .. .. | .. | 21,000 | 21,000 | — |
| 8. *Reserve* .. .. .. .. .. | .. | 31,000 | 31,000 | — |
| A. REGULAR ARMY .. .. .. | .. | .. | 223,538 | 26,487 |
| B. AUXILIARY FORCES. | | | | |
| 1. *Yeomanry*, 40 regiments .. .. .. .. | 804 | 14,274 | 15,078 | 16,000 |
| 2. *Militia* :— | | | | |
| Artillery, 29 regiments .. .. .. .. | 3497 | 16,422 | 139,619 | 800 |
| Infantry, 131 battalions .. .. .. .. | | 119,700 | | |
| 2. *Militia* .. .. .. .. .. | 4301 | 150,396 | 154,697 | 16,800 |
| 3. *Volunteers* :— | | | | |
| Artillery .. .. .. .. .. .. | Separate numbers are not given. | | 31,823 | 1,500 |
| Cavalry, Light horse, 4 regiments .. .. | | | 366 | 530 |
| Cavalry, Mounted rifles, 4 regiments .. | | | 139 | |
| Engineers .. .. .. .. .. .. | | | 6,296 | 100 |
| Infantry .. .. .. .. .. .. | | | 128,669 | 800 |
| Permanent staff .. .. .. .. .. | | | 1,458 | 270 |
| 3. *Volunteers* .. .. .. .. .. | .. | .. | 168,751 | 3,200 |
| B. AUXILIARY FORCES .. .. .. | .. | .. | 323,448 | 20,000 |
| A. ACTIVE ARMY .. .. .. .. | .. | .. | 223,538 | 26,487* |
| TOTAL STRENGTH .. .. .. | .. | .. | 546,986 | 46,487 |

* Exclusive of officers' horses.

## II.—STRENGTH OF AN ARMY CORPS IN THE BRITISH SERVICE.

| | Officers. | | Non-commissioned Officers and Men. | All Ranks. | Horses. | Guns. |
|---|---|---|---|---|---|---|
| | Combatant. | Non-combatant. | | | | |
| *Staff and Departments.* | | | | | | |
| Army corps | 19 | 88 | 1,722 | 1,829 | 625 | — |
| 3 divisions | 30 | 159 | 915 | 1,104 | 750 | — |
| 1 cavalry brigade | 3 | 17 | 113 | 133 | 115 | — |
| 6 infantry brigades | 18 | 138 | 1,074 | 1,230 | 972 | — |
| Total staff | 70 | 402 | 3,824 | 4,296 | 2,462 | — |
| | 472 | | | | | |
| *Infantry.* | | | | | | |
| 21 battalions | 588 | 63 | 22,386 | 23,037 | 1,218 | — |
| | 651 | | | | | |
| *Cavalry.* | | | | | | |
| 3 regiments attached one to each division | 81 | 12 | 1,866 | 1,959 | 1,845 | — |
| 1 brigade (3 regiments) | 81 | 12 | 1,866 | 1,959 | 1,845 | — |
| Total cavalry | 162 | 24 | 3,732 | 3,918 | 3,690 | — |
| | 186 | | | | | |
| *Artillery.* | | | | | | |
| Regimental staff | 4 | .. | 2 | 6 | 11 | — |
| Horse artillery 1 battery, attached to cavalry brigade | 5 | 2 | 172 | 179 | 179 | 6 |
| 3 batteries in reserve | 15 | 6 | 516 | 537 | 537 | 18 |
| Field artillery 9 batteries, attached to divisions | 45 | 18 | 1,641 | 1,704 | 1,308 | 54 |
| 2 batteries in reserve | 10 | 4 | 382 | 396 | 308 | 12 |
| 3 infantry and artillery reserve ammunition columns | 12 | 6 | 618 | 636 | 759 | — |
| 1 army corps ammunition reserve | 12 | 6 | 516 | 534 | 549 | — |
| Total artillery | 103 | 42 | 3,847 | 3,992 | 3,651 | 90 |
| | 145 | | | | | |
| *Engineers.* | | | | | | |
| 3 companies, attached one to each division | 15 | .. | 558 | 573 | 138 | — |
| Regimental staff | 2 | .. | .. | 3 | 5 | — |
| 1 company, and field park, in reserve | 6 | .. | 209 | 215 | 91 | — |
| 1 troop pontoon train | 6 | 3 | 313 | 322 | 246 | — |
| ½ telegraph troop | 3 | 3 | 143 | 149 | 102 | — |
| Total engineers | 32 | 6 | 1,223 | 1,262 | 582 | — |
| | 38 | | | | | |
| *Military Police.* | | | | | | |
| 3 troops, attached one to each division | 6 | .. | 219 | 225 | 195 | — |
| 1 troop attached to head-quarters | 2 | .. | 73 | 75 | 65 | — |
| Grand total of army corps | 963 | 537 | 35,304 | 36,805 | 11,863 | 90 |
| | 1,500 | | | | | |

## III.—DETAIL OF AN ARMY CORPS.

| | Officers. | Non-commissioned Officers and Men. | Drivers. | Total, all Ranks. | Guns. | Horses. | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Draught. | Riding. | Pack. | Total. |
| *Staff.* | | | | | | | | | |
| Staff of army corps .. .. | 23 | 15 | .. | 38 | .. | .. | 77 | .. | 77 |
| Commissariat department attached to head-quarters .. | 5 | 16 | 13 | 34 | .. | 26 | 11 | .. | 37 |
| | 28 | 31 | 13 | 72 | .. | 26 | 88 | .. | 114 |
| *A Brigade of Cavalry.* | | | | | | | | | |
| Staff .. .. .. .. | 3 | 1 | .. | 4 | .. | .. | 11 | .. | 11 |
| 1 battery horse artillery .. | 7 | 102 | 70 | 179 | 6 | 102 | 77 | .. | 179 |
| 3 regiments .. .. .. | 93 | 1,800 | 66 | 1,959 | .. | 132 | 1,713 | .. | 1,845 |
| Medical department .. .. | 12 | 54 | 29 | 95 | .. | 58 | 12 | .. | 70 |
| Veterinary " .. .. | 2 | 3 | .. | 5 | .. | .. | 4 | .. | 4 |
| Chaplain's " .. .. | 1 | .. | .. | 1 | .. | .. | 1 | .. | 1 |
| Commissariat " .. .. | 2 | 13 | 13 | 28 | .. | 26 | 3 | .. | 29 |
| | 120 | 1,973 | 178 | 2,271 | 6 | 318 | 1,821 | .. | 2,139 |
| *1st Division.* | | | | | | | | | |
| Staff .. .. .. .. | 15 | 8 | .. | 23 | .. | .. | 39 | .. | 39 |
| 1st brigade {Staff .. .. | 3 | 1 | .. | 4 | .. | .. | 11 | .. | 11 |
| 1st brigade {3 battalions .. | 93 | 3,126 | 72 | 3,291 | .. | 144 | 30 | .. | 74 |
| 2nd brigade {Staff .. .. | 3 | 1 | .. | 4 | .. | .. | 11 | .. | 111 |
| 2nd brigade {3 battalions .. | 93 | 3,126 | 72 | 3,291 | .. | 144 | 30 | .. | 174 |
| 1 regiment of cavalry .. | 31 | 600 | 22 | 653 | .. | 44 | 571 | .. | 615 |
| 1 battalion of rifles .. .. | 31 | 1,042 | 24 | 1,097 | .. | 48 | 10 | .. | 58 |
| 3 field batteries {1 9-pr. .. | 7 | 103 | 62 | 172 | 6 | 98 | 30 | .. | 128 |
| 3 field batteries {2 16-pr. | 14 | 236 | 146 | 396 | 12 | 248 | 60 | .. | 308 |
| 1 infantry and artillery reserve ammunition column | 6 | 85 | 121 | 212 | .. | 230 | 23 | .. | 253 |
| 1 company royal engineeers | 5 | 170 | 16 | 191 | .. | 32 | 14 | .. | 46 |
| 1 troop military police .. | 2 | 73 | .. | 75 | .. | .. | 65 | .. | 65 |
| *Medical department .. | 80 | 354 | 166 | 600 | .. | 332 | 44 | .. | 376 |
| Veterinary " .. .. | 2 | 20 | .. | 22 | .. | .. | 4 | .. | 4 |
| Chaplain's " .. .. | 3 | .. | .. | 3 | .. | .. | 3 | .. | 3 |
| †Commissariat " .. .. | 9 | 58 | 55 | 122 | .. | 114 | 16 | .. | 130 |
| | 397 | 9,003 | 756 | 10,156 | 18 | 1,434 | 961 | .. | 2,395 |
| *2nd Division.* | | | | | | | | | |
| Staff .. .. .. .. | 15 | 8 | .. | 23 | .. | .. | 39 | .. | 39 |
| 1st brigade {Staff .. .. | 3 | 1 | .. | 4 | .. | .. | 11 | .. | 11 |
| 1st brigade {3 battalions .. | 93 | 3,126 | 72 | 3,291 | .. | 144 | 30 | .. | 174 |
| 2nd brigade {Staff .. .. | 3 | 1 | .. | 4 | .. | .. | 11 | .. | 11 |
| 2nd brigade {3 battalions .. | 93 | 3,126 | 72 | 3,291 | .. | 144 | 30 | .. | 174 |
| 1 regiment of cavalry .. | 31 | 600 | 22 | 653 | .. | 44 | 571 | .. | 615 |
| 1 battalion of rifles .. .. | 31 | 1,042 | 24 | 1,097 | .. | 48 | 10 | .. | 58 |
| 3 field batteries {1 9-pr. .. | 7 | 103 | 62 | 172 | 6 | 98 | 30 | .. | 128 |
| 3 field batteries {2 16-pr. | 14 | 236 | 146 | 396 | 12 | 248 | 60 | .. | 308 |
| 1 infantry and artillery reserve ammunition column | 6 | 85 | 121 | 215 | .. | 230 | 23 | .. | 253 |
| 1 company royal engineers | 5 | 170 | 16 | 191 | .. | 32 | 14 | .. | 46 |
| 1 troop military police .. | 2 | 73 | .. | 75 | .. | .. | 65 | .. | 65 |
| *Medical department .. | 80 | 354 | 166 | 600 | .. | 332 | 44 | .. | 376 |
| Veterinary " .. .. | 2 | 20 | .. | 22 | .. | .. | 65 | .. | 4 |
| Chaplain's " .. .. | 3 | .. | .. | 3 | .. | .. | 4 | .. | 3 |
| †Commissariat " .. .. | 9 | 58 | 55 | 122 | .. | 114 | 3 | .. | 130 |
| | 397 | 9,003 | 756 | 10,156 | 18 | 1,434 | 961 | .. | 2,395 |

* Includes brigade medical department. † Includes brigade commissariat department.

## APPENDIX

### I.—BREECH-LOADING RIFLES ADOPTED

| Class.* | Power. | Name. | Weight with Bayonet. | Weight without Bayonet. | Length with Bayonet. | Length without Bayonet. | Calibre of Rifle. |
|---|---|---|---|---|---|---|---|
| | | | lbs. | lbs. | ft. | ft. | in. |
| H.B.*u* | Austria | Werndl | 11·22 | 9·87 | 5·70 | 4·16 | 0·43 |
| W.A. | Bavaria | Werder | 11·22 | 9·31 | 5·83 | 4·26 | 0·43 |
| H.B.*o* | Belgium | Albini | .. | 10·14 | .. | .. | 0·43 |
| W.A. | Denmark | Remington | .. | 9·08 | .. | .. | 0·45 |
| W.A. | England | Martini-Henry | 10·25 | 8·75 | 5·75 | 4·12 | 0·45 |
| H.B.*s* | „ Snider converted | Enfield, long | 9·85 | 8·92 | 5·96 | 4·5 | 0·577 |
| „ | „ | „ short | 10·5 | 8·75 | 5·94 | 4·04 | 0·577 |
| „ | „ | Artillery carbine | 9·18 | 7·45 | 5·27 | 3·35 | 0·577 |
| „ | „ | Cavalry „ | .. | 6·64 | .. | 3·07 | 0·577 |
| „ | „ | Lancaster „ | 9·75 | 8·10 | 5·25 | 5·95 | 0·577 to 0·593 |
| B.A. | France | Gras | 10·26 | 8·9 | 6·09 | 4·25 | 0·43 |
| „ | Germany | Mauser | 11·22 | 10·5 | 5·70 | 4·16 | 0·43 |
| H.B.*s* | Holland | Beaumont | 10·42 | 9·60 | 6 | 4·33 | 0·43 |
| M. | Italy | Vetterli | .. | 6·61 | .. | .. | 0·41 |
| W.A. | Norway and Sweden | Remington | .. | 9·08 | .. | .. | 0·45 |
| H.B.*o* | Russia | Berdan | .. | 8·48 | .. | .. | 0·42 |
| W.A. | Spain | Remington | .. | 9·08 | .. | .. | 0·45 |
| M. | Switzerland | Vetterli | .. | 6·61 | .. | .. | 0·41 |
| W.A. | Turkey | Martini-Henry | .. | 8·75 | .. | 4·12 | 0·45 |

REVOLVERS

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Revolvers | England | Adams | .. | 2·45 | .. | 1·05 | 0·443 |
| | | Colt | .. | 2·60 | .. | 1·14 | 0·358 |
| | | Deane | .. | 2·40 | .. | 1·67 | 0·434 |
| Pistols | | Cavalry 10-inch | .. | 3·12 | .. | 1·15 | 0·677 |
| | | „ 8-inch | .. | 2·64 | .. | 1·16 | 0·577 |

---

* B.A. bolt action; W.A. wedge action; H.B.*s*, *u*, or *o*, hinged block, turning

† It is probable that the commissariat and royal artillery will shortly be supplied

‡ Chassepôt carbine has been retained for the cavalry. Weight, with bayonet,

## F.

### BY THE POWERS OF EUROPE.

| Bullet. | | | Cartridge. | | Number of Grooves. | Twist of Rifling. | REMARKS. |
|---|---|---|---|---|---|---|---|
| Calibre. | Weight. | Length. | Charge. | Weight. | | | |
| in. | grs. | in. | grs. | grs. | | | |
| .. | 386 | .. | 76 | 494 | 6 | 1 in 28 | New Pattern (1876). |
| .. | 338·9 | ·866 | 77 | 555 | 4 | 1 in 30 | The Bavarian army will be eventually armed with the Mauser rifle. |
| 0·41 | 385·8 | ·97 | 77 | 617 | 4 | 1 in 22 | |
| .. | 385·8 | ·96 | 77 | 563 | 7 | 1 in 30 | |
| 0·45 | 410 | 1·27 | 80 | 756 | 7 | 1 in 22 | Guards and infantry of the line; royal engineers; 1st and 2nd W. I. regiments. |
| 0·573 | 480 | 1·04 | 70 | 817 | 3 | 1 in 78 | Militia, volunteer corps, and some N. I. regiments, India. |
| 0·573 | 480 | 1·04 | 70 | 817 | 5 | 1 in 48 | Royal marine artillery; sergeants of militia and volunteer corps. |
| 0·573 | 480 | 1·04 | 70 | 705 | 5 | 1 in 48 | Royal artillery, commissariat, militia and volunteer artillery.† |
| 0·573 | 480 | 1·04 | 70 | 705 | 5 | 1 in 48 | Cavalry regiments, except lancers. |
| 0·573 | 480 | 1·04 | 70 | 705 | Oval bore | Variable | Royal engineers, until very lately. They have now been supplied with the Martini-Henry. |
| 0·429 | 385 | 1·09 | 81 | .. | 4 | 1 in 21¼ | Chassepôt converted.‡ |
| 0·429 | 385 | .. | 77 | 648 | 4 | 1 in 22 | Jäger and pioneer rifles, carbines, and wall guns, same calibre. |
| 0·429 | 385 | .. | 66 | .. | 4 | 1 in 30 | Introduced in 1870. |
| 0·42 | 316 | 1·02 | 58 | 550 | 4 | 1 in 39 | Can be used as a single or magazine rifle. |
| .. | 385·8 | ·96 | 77 | 563 | 7 | 1 in 30 | |
| .. | 370 | .. | 78 | .. | .. | .. | |
| .. | 385·8 | ·96 | 77 | 563 | 7 | 1 in 30 | |
| 0·42 | 316 | 1·02 | 58 | 550 | 4 | 1 in 39 | |
| 0·45 | 410 | 1·27 | 80 | 756 | 7 | 1 in 22 | Although adopted by Turkey, few regiments are in possession of this rifle; others are armed with the Snider, long and short. |

AND PISTOLS.

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| .. | .. | .. | 13 | .. | 5 | 1 in 24 | |
| .. | .. | .. | 13 | .. | 7 | 1 in 36 | |
| .. | .. | .. | 15 | .. | 3 | 1 in 20 | |
| 0·568 | 390 | ·568 | 27 | 303 | 5 | 1 in 48 | Lancer regiments and troop sergeant-majors of cavalry. |
| 0·568 | 390 | ·568 | 27 | 303 | 5 | 1 in 48 | Ditto in India. |

**on an axis at the side, under, or over; M. magazine gun.**

**with the *Martini-Henry rifle.***

***8·5 lbs., without, 7·71; length,* with bayonet, 5·09 feet, without, 3·15.**

## II.—TABLE OF THE LENGTHS, WEIGHTS, ETC. OF THE SWORDS USED IN THE BRITISH SERVICE.

| | Description. | Length of Blade. | | Weight of Sword. | | Weight of Scabbard. | | Total Weight. | | **Remarks.** |
|---|---|---|---|---|---|---|---|---|---|---|
| | | ft. | in. | lbs. | oz. | lbs. | oz. | lbs. | oz. | |
| 1 | Sword, pattern 1853 (for all heavy and light cavalry and other mounted corps) | 2 | 11½ | 2 | 7¾ | 2 | 1¼ | 4 | 9 | The household cavalry have a special sword. |
| 2 | Sword, pattern 1864, do., do., do. .. | 2 | 11½ | 2 | 7¾ | 2 | 1¼ | 4 | 9 | No. 2 pattern will gradually supersede No. 1. The blade is the same, but the hilt is solid, of homogeneous steel, the weight so arranged as not to disturb the balance when it is fitted to swords of No. 1 pattern. The scabbards are of iron lined with wood. |
| 3 | Sword, pattern 1856, for staff sergeants, royal artillery .. .. .. | 2 | 8½ | 1 | 12¼ | 1 | 3 | 2 | 15¼ | In 1866 the blades of the staff sergeants' swords, of line and rifle regiments, were assimilated to those of the staff sergeants, royal artillery and royal engineers. The hilts of the swords and the mountings of the scabbards are of steel for artillery and rifles, and gilt for the engineers and line. The scabbards of the artillery and engineers are of iron, of the line and rifles of leather. |
| 4 | Sword, pattern 1862, for staff sergeants, royal engineers .. .. .. | 2 | 8½ | 1 | 14¼ | 1 | 3 | 3 | 1¼ | |
| 5 | Sword, pattern 1866, for staff sergeants, rifle corps* .. .. .. .. | 2 | 8½ | 1 | 12¾ | 0 | 13½ | 2 | 10¼ | |
| 6 | Sword, pattern 1866, for staff sergeants, infantry of the line .. .. .. | 2 | 8½ | 1 | 15½ | 0 | 14 | 2 | 13½ | |
| 7 | Sword, for staff sergeants, Highland regiments .. .. .. .. | 2 | 8½ | 2 | 11¾ | 0 | 12¼ | 3 | 8 | The claymores have leather scabbards, the hilt and mountings of steel; the scabbards of staff sergeants of regiments wearing the trews have top and centre ring lockets and a shoe to the tip of the scabbard. |
| 8 | Dirk, for drummers, pipers, band, and Highlanders .. .. .. .. | 1 | 0 | 0 | 12½ | 0 | 7 | 1 | 3½ | |
| 9 | Sword, pattern 1857, for drummers and band, line regiments*.. .. .. | 1 | 7½ | 1 | 14 | 0 | 10 | 2 | 8 | Drummers' swords and scabbards are brass-mounted for line regiments, and iron mounted for rifles. |
| 10 | Sword, pattern 1858, for buglers and band, rifle regiments* .. .. | 1 | 7 | 1 | 13 | 0 | 8½ | 2 | 5½ | Militia artillery buglers carry a special hilt sword bayonet. |
| 11 | Sword, pattern 1856, for pioneers .. | 1 | 10½ | 2 | 4½ | 0 | 12 | 3 | 0½ | The pioneers' sword has a saw back, leather scabbard, and brass mountings. |
| 12 | Cutlass, for royal navy .. .. .. | 2 | 1½ | 2 | 5 | 0 | 12 | 3 | 1 | The blade of the last pattern naval cutlass is identical with that of the cutlass sword bayonet. Naval cutlasses have leather scabbards with brass mountings and a spring inside to prevent the cutlass falling out. |
| 13 | Sword, for staff sergeants, army hospital corps and reserve forces .. | 2 | 8½ | 1 | 14¾ | 0 | 13¼ | 2 | 12 | Except militia artillery and rifles, brass hilt with leather scabbard. |
| 14 | Sword, army hospital corps, sergeants.. | 2 | 4½ | 1 | 7½ | 0 | 7 | 1 | 14½ | Brass hilt, with leather scabbard brass-mounted. |
| 15 | Ditto ditto privates | 2 | 2½ | 2 | 2½ | 0 | 7 | 2 | 9½ | |

* Also for militia.

## III.—TRAJECTORY OF THE MARTINI-HENRY RIFLE.

| Distance. | Culminating Point, or the Greatest Height of the Trajectory, about | First Catch. | | Margin for | | First Graze. |
|---|---|---|---|---|---|---|
| | | Cavalry. | Infantry. | Cavalry. | Infantry. | |
| yds. | ft. | yds. | yds. | yds. | yds. | yds. |
| 100 | 4½ | Throughout | | | | 205 |
| 200 | 5 | Throughout | | | | 285 |
| 300 | 6¾ | Through-out | 205 | Through-out | 155 | 360 |
| 400 | 9¾ | 285 | 345 | 170 | 105 | 450 |
| 500 | 12¼ | 410 | 455 | 130 | 85 | 540 |
| 600 | 16¼ | 530 | 565 | 100 | 65 | 630 |
| 700 | 20¾ | 645 | 670 | 80 | 55 | 725 |
| 800 | 26¾ | 750 | 775 | 70 | 40 | 820 |

## IV.—TRAJECTORY OF THE SNIDER-ENFIELD RIFLE.

| Distances. | Culminating Point, or the Greatest Height of the Trajectory, about | First Catch. | | Margin for | | First Graze. | Remarks. |
|---|---|---|---|---|---|---|---|
| | | Cavalry. | Infantry. | Cavalry. | Infantry. | | |
| yds. | ft. | yds. | yds. | yds. | yds. | yds. | |
| 100 | 4½ | Throughout | | | | 180 | The calculated height for cavalry is 8½ feet, that for infantry 6 feet.<br>The rifle 4½ feet above the ground, at distances to 300 yards; beyond that distance, 3 feet above the ground.<br>The object hit 3 feet above the ground at each distance.<br>The culminating point is between ½ and ⅗ of the distance. |
| 200 | 5 | Throughout | | | | 280 | |
| 300 | 7 | Thro'-out | 220 | Thro'-out | 135 | 355 | |
| 400 | 11 | 300 | 360 | 140 | 90 | 440 | |
| 500 | 15 | 420 | 465 | 100 | 55 | 520 | |
| 600 | 23 | 570 | 585 | 45 | 30 | 615 | |
| 700 | 32 | 670 | 685 | 40 | 25 | 710 | |
| 800 | 44 | 780 | 790 | 30 | 20 | 810 | |

N.B.—The first catch and first graze are given in divisions of 5 yards to assist the memory, hence are only approximations.

# APPENDIX G.

## INSTRUCTIONS AS TO THE APPLICATION OF LIGHTNING CONDUCTORS FOR THE PROTECTION OF POWDER MAGAZINES AND OTHER BUILDINGS.

1. The principles on which buildings should be protected against lightning are set forth in papers drawn up by the late Sir William Snow Harris, F.R.S. These principles are still generally held to be sound, and should be carefully considered with reference to any system of lightning conductors. In consequence, however, of the progress of electrical science, some modifications are necessary in the application of these principles.

2. In considering the application of conductors for the protection of buildings, it should be understood that the terminating plane of the action of lightning is sometimes beneath the surface of the ground, where, from the presence of moisture, the earth forms a good medium for the diffusion of electricity.

3. Light, dry soil, such as shingle and sand, or even ordinary vegetable soils when in a dry condition, may, for the present purpose, be regarded in most cases as non-conducting matter resting upon the electric surface of the earth.

4. Lightning conductors should therefore invariably be continued through these intervening substances into soil which is permanently damp.

5. Underground magazines are usually in dry soil, or soil rendered dry by careful drainage.

6. When large quantities of explosives are stored in underground magazines, such as the main magazine of a fort, they should be fitted with lightning conductors on the same principles as ordinary magazines above ground. The same rule holds good as regards underground magazines situated on prominent points, the top of a hill for example, under which circumstances like precautions should be taken.

7. Small expense magazines underground need not, as a rule, be provided with lightning conductors.

8. Casemated batteries of modern construction, in which the magazines are distributed throughout the basement story, must be provided with lightning conductors.

9. The arrangements will vary with the plan and extent of the work; but it will generally be convenient to have one or two horizontal conductors on the parapet or terreplein, extending from end to end of the battery, attached to vertical conductors connected with the earth. The flagstaff should have a conductor, terminating in the truck, or a point above the truck, and in large works several points, projecting 5 feet above the top of the building, must be provided. Iron verandahs and iron railings form good conductors when they are properly connected with the earth.

10. An iron building is of itself a good conductor, but when it is covered with non-conducting substances, such as asphalte and concrete, it is necessary to provide rods or points projecting above the asphalte, and in all cases there must be a proper connection with the earth. Iron shields in casemated works must be placed in connection with the conductors; this may be effected through the iron racers in their rear, or by means of horizontal bands, extending from one shield to another, externally.

11. Copper is recommended by the late Sir William Snow Harris as the best

material for lightning conductors. It possesses great conductivity, is not liable to corrosion, and is very durable.

12. Where, however, conductors are exposed to mechanical injury or are liable to be stolen, and where attendant circumstances are not such as to promote corrosion, iron may be employed, using proportionately larger dimensions to provide for its smaller conductivity, which is only about one-fifth that of copper.

13. Copper lightning conductors should be of the following dimensions: rods, ½ inch in diameter, tubes ⅝ inch in diameter and ⅜ inch thick, or bands 1½ inch wide and ⅛ inch thick.

14. Iron lightning conductors should be either solid rods 1 inch in diameter, or bands 2 inches wide and ⅜ inch thick.

15. In deciding upon the metal to be employed in any system of lightning conductors, the relative qualities of the two metals, copper and iron, must be weighed in connection with the circumstances of each particular case. Copper possesses higher conductivity, and is less liable to injury from corrosion, but it is very much more expensive, more liable to mechanical injury, and more likely to be stolen. Its fusing temperature (1994° Fahrenheit) is much lower than that of iron.

16. The fusing temperature of iron is 2786° Fahrenheit. In this respect it has a marked advantage over copper, but it readily becomes rusty, and when rusted its electrical resistance is immensely increased. Roughly speaking, an equal amount of conducting power may be obtained in iron and copper for the same cost, the number of conductors purchaseable for the same price in the former being far in excess of those in the latter metal, and in suitable positions the more numerous conductors would, no doubt, provide perfectly efficient protection.

17. In applying lightning conductors, the expansion and contraction of the metal must be provided for, especially at points where two lengths of metal are joined together.

18. This may be done by introducing suitable bends, at intervals, in long lines of horizontal conductor.

19. In vertical lines, and in some cases in horizontal lines, the effect of expansion and contraction may be sufficiently provided against by giving freedom to slip through the bearing collars.

20. Soldered or welded joints are not absolutely necessary, but they should be employed where practicable.

21. The joints hitherto used in the royal engineer department, under the recommendation of the late Sir William Snow Harris, should be adopted for copper conductors where soldered joints cannot be employed.

22. Soldered or welded joints should be employed in all positions where the brush or discharge, which might occur with unsoldered joints, would be liable to ignite dust or any inflammable substance.

23. Iron rods may be welded or connected by joints similar to those recommended for copper conductors, or by screw junctions such as are used in forming the connections of gas-pipes, the end of the rod inserted into the socket being equal in length at least to its diameter, but no white-lead, which is a bad conductor of electricity, should be made use of in the joints.

24. Flat iron bands, where welding is not considered advisable, may be connected by rivets or screws working in slots to allow for expansion and contraction; each of the surfaces in contact should be of at least six times the sectional area of the band.

25. Copper bands should be connected by rivets or screws working in slots, and with similar precautions as to the area of the surfaces in contact. Joints between different metals may be soldered, screwed, or riveted, the extent of the surfaces in contact being regulated by the dimensions of the metal possessing the least conducting power. In all cases of contact between two metals, precautions should be taken *to prevent* access of moisture, which would induce local *galvanic action with its* attendant metallic decomposition.

26. It is not possible to assign the precise limits of the protecting power of conductors. The French philosophers formerly considered that they afforded protection over a circle whose radius was equal to twice their height; but in England the limit is usually considered the radius of their height from the ground. This may be sufficiently correct for all practical purposes; but such a radius of protection cannot always be relied upon.

27. Conductors of themselves have no attraction for lightning, which seeks them only on account of the facility they afford for the combination of the opposed states of the electricity of the clouds and of the earth beneath them, separated by the atmosphere, which is a bad conductor. A lightning conductor, buildings, trees, or any object on the surface of the earth, is only to be regarded as diminishing the resistance due to the air. When an electrified cloud is passing over the earth, and its potential is just counteracted by the resistance of the air, a body, however small, which reduces this resistance, will cause a discharge. Even a change in the nature of the soil over which the cloud is passing may have this effect, and it is very frequently produced by a fall of rain.

28. From this we may conclude that the angle of a building which a thundercloud approaches may receive the discharge, while another but more distant angle is provided with a conductor; and that, for important buildings containing explosive materials, every prominent elevated part ought to be provided with a lightning conductor.

29. For a building of uniform height, a solid rod, pointed and rising not less than 5 feet above it, should be provided at each end, and at intervals of about 15 yards along its length. When the rod is of iron, its point should be gilt.

30. Small simple buildings, not exceeding 20 feet in length, may be protected by one vertical conductor at the end, the point rising not less than 5 feet above the ridge of the roof; a horizontal conductor should be provided on the ridge.

31. A building from 20 feet to 40 feet long should be protected by one vertical conductor in the centre of its length, with a horizontal conductor on the ridge.

32. A building exceeding 40 feet in length should have two, and if exceeding 100 feet in length, three conductors.

33. Larger and more complicated buildings should be protected upon similar principles.

34. A fork, or brush of three or four points instead of one, has been recommended for the top of a lightning conductor, the practical value of this arrangement is not apparent unless the points are widely separated; but for a single rod on a prominent point, this construction may be adopted. All parts of buildings which are of marked elevation and prominence should be fitted with a lightning conductor.

35. Where several lightning conductors are used in a single building, they should be connected horizontally. Such connection may be conveniently effected along the ridge oreaves. When the ridge covering or eaves gutters are of metal, they should invariably be connected with the system. All metal surfaces, whether lead, copper, or iron, in ridges, roofs, gutters, or coverings to doors or windows, shall be connected with the conducting system.

36. The relative conductivity of the ordinary metals used in building is given by the late Sir William Snow Harris, as follows:—

| Lead. | Tin. | Iron. | Zinc. | Copper. |
|---|---|---|---|---|
| 1 | 2 | 2½ | 4 | 12 |

Lead, on account of its low conducting power, cannot be altogether depended on, and this must be carefully considered in connecting the lead, used in a building, to the system.

37. Long lengths of horizontal conductor, without sufficient intermediate earth connections, must be avoided. Should there be any failure of continuity in such a conductor without intermediate earth connections, the current might leave the conductor and pass to earth by the most favourable course, and this would be attended with danger. Sharp angles in conductors are objectionable.

38. Good earth connections are most important. Any fault in the earth connection itself manifestly impairs efficiency, and a very bad earth connection is a source of absolute danger. Lightning conductors should, where practicable, be led into springs or wells of water, or into ground which is permanently wet. The sea or any large body of water, except a watertight tank, forms an excellent earth connection. Shingle, dry sand, or ordinary vegetable mould in a dry condition, are not efficient connections, and lightning conductors should invariably be led through these into ground that is permanently damp. Several earth connections should always be provided in all large systems of lightning conductors, so that, should one be defective, the discharge may be effected through the others.

39. Conductors should be led into moist ground, by means of a trench or trenches extending to a depth of at least 18 inches below the surface, and in which a length of not less than 30 feet of metal should be in actual contact with moist earth.

40. Where practicable, it is desirable to lead a flow of water, from the down pipes from the roof, over the ground in the vicinity of the lightning conductors and earth connections.

41. Where a lightning conductor terminates in rocky, or more or less dry soil, special precautions are necessary; it should be led into a trench, so disposed as to obtain all the moisture possible from the ground. These trenches should extend from its foot to distances of from 10 to 40 yards, according to the amount of moisture.

42. The connections in the trenches may be of railway or other old iron formed into a continuous metallic surface, the trenches being filled up with cinders or coal ashes, and the water from the down pipes being led over them as already recommended. Water-pipes form excellent earth connections, but gas-pipes should never be used for this purpose, instances having occurred where a heavy lightning discharge has damaged the gas-pipes and lit the gas.*

43. Lightning conductors should be frequently inspected, to ascertain that they are in perfect condition and properly connected with the earth. Particular attention should be paid to the joints, especially when they connect different metals.

44. The state of the conductors should be noticed in the inspectional reports, in which the efficiency or otherwise of all joints and earth connections, and the extent of oxidation of iron conductors should be distinctly specified. It must be borne in mind that in the case of an iron rod or band, the metallic portion only can be looked upon as efficient, oxide of iron being a very inferior conductor.

45. In order to obviate the ill-effects of rust, iron employed in the construction of lightning conductors should be galvanised.

46. When galvanised iron is used, particular care should be taken to see that the coating of zinc covers the conductor thickly and effectively; damp would produce galvanic action, and the zinc in the vicinity of the smallest exposed iron surface would be quickly decomposed.

47. Should it be necessary to bring the zinc coating in contact with other metals, and especially with copper, every precaution should be adopted to exclude moisture, for the above reason.

FRED. E. CHAPMAN,
*Inspector-General of Fortifications.*

WAR OFFICE,
*April* 6, 1875.

*The appendices and plates mentioned in the original instructions have been omitted.*

---

* A remarkable accident of this nature occurred at Halifax, Nova Scotia, in the summer of 1871, during a heavy thunderstorm; the electric discharge, in traversing the gas-pipes of the old Provincial Buildings, fused a portion which was composed of white metal composition, near the metre in the basement, and lit the gas, by which the buildings were nearly set on fire.

# APPENDIX H.

THE FOLLOWING TABLE GIVES THE CHARGES OF GUNPOWDER TO BE EMPLOYED FOR HASTY DEMOLITION OF BRIDGES, BOMB-PROOFS, STOCKADES.*

| Charge of Gunpowder in lbs. | Character of Demolition. | Position of the Charges, Intervals, &c. | REMARKS. |
|---|---|---|---|
| $\frac{3}{2}$ L.L.R.$^3$ × B | Arch of a bridge, B being the breadth of the bridge | In a trench over the crown of the arch, or suspended under the crown of the arch | This is the total charge. The gap made in the arch would be greater if two trenches were made across the arch, and each trench loaded with the charge here given. |
| 3 L.L.R.$^3$ .. | Arch of bridge .. | In a trench over the crown of the arch, or suspended under it | This is the amount for each charge, the charges being placed at two-lined intervals.<br>These modes are precarious. If time permits, the arch or wall should be cut into, and the charges covered with stones and rubbish. The gap made would be greater if two trenches were cut, and each treated similarly. |
| $2\frac{1}{2}$ *to* 3 L.L.R.$^3$ | Wall .. .. .. | Against the wall at two-lined intervals | |
| $\frac{1}{8}$ L.L.R.$^3$ .. | Powder magazine or bomb-proof underground | Along the centre line of each square with side of twice L.L.R. | The charge is that for each square, and may be placed in one or more masses, if preferred. All the openings should be blocked up. Use at least three barrels. |
| $\frac{1}{5}$ L.L.R.$^3$ .. | Square bomb-proof casemates | In the centre of the building | An increase of charge from one-third to one-half may make the difference between partial injury and complete demolition, or between moderate and violent demolition.<br>If a range of casemates, attack that at the end, and then every alternate casemate.<br>All the openings should be blocked up; if the casemate be open to the rear, more powder must be used. |
| $\frac{1}{4}$ L.L.R.$^3$† .. | Bomb-proof casemates of two squares | In the centre of each square | |
| $\frac{3}{8}$ L.L.R.$^3$† (90† lbs.) .. | Bomb-proof casemates of three squares | In the centre of each square | |
| 1 barrel (90 lbs.) | Galleries or countermines | In the centre of the gallery at 10-foot intervals | Both ends of the gallery should be tamped. These charges would probably convert the gallery 15 feet total depth, below the surface, into an open trench. |
| 40 to 100 lbs. .. | Barrier-gate or stockade | Against the centre of the gate or stockade, or on the ground at the foot | The charges should be placed in sandbags or leather powder-bags. The effect is much increased if five sandbags, filled with earth, be placed round the charge; 40 lbs. of powder thus tamped will have about the same effect as 60 lbs. untamped. |

* From 'Instructions in Military Engineering,' Chatham, 1870.

† The lines of least resistance (L.L.R.) are measured from the centre of the powder on the floor to the nearest external surface of the building.

# APPENDIX I.

## I.—RECRUITING STANDARDS.

| Corps. | Years of Age. |  | Height. |  |  |  | Chest Measurement. | Percentage of Enlistments for |  |
|---|---|---|---|---|---|---|---|---|---|
|  | From | To | From |  | To |  |  | Long Service. | Short Service. |
|  |  |  | ft. | in. | ft. | in. | in. |  |  |
| Cavalry, heavy .. .. .. .. .. | 18 | 25 | 5 | 8 | 5 | 11 | 34 | 25 | 75 |
| „ medium .. .. .. .. .. | 18 | 25 | 5 | 7 | 5 | 9 | 33 |  |  |
| „ light .. .. .. .. .. | 18 | 25 | 5 | 6 | 5 | 8 | 33 |  |  |
| Royal artillery, gunners .. .. .. .. | 18 | 25 | 5 | 7 | Upwards |  | 33 | 50 | 50 |
| „ drivers .. .. .. .. | 19 | 25 | 5 | 4½ | 5 | 6½ | 35 |  |  |
| „ tested artificers .. .. | 17 | 25 | 5 | 5 | Upwards |  | 33 |  |  |
| Royal Engineers, sappers ... .. .. | 18 | 25 | 5 | 6 | „ |  | 33 | .. | All. |
| „ drivers .. .. .. .. | 19 | 25 | 5 | 4½ | 5 | 6 | 35 |  |  |
| Foot guards .. .. .. .. .. | 18 | 25 | 5 | 8 | Upwards |  | 34 | 50 | 50 |
| Infantry of the line .. .. .. .. | 18 | 25 | 5 | 5 | „ |  | 33 | 25 | 75 |
| Rifles .. .. .. .. .. .. | 18 | 25 | 5 | 4½ | 5 | 7 | 34 |  |  |
| Boys .. .. .. .. .. .. | 14 | 16 |  |  |  |  |  |  |  |
| Re-enlistments .. .. .. .. .. | .. | 34 | .. | .. | .. | .. | .. | All. |  |

A recruit for any branch of the service who is 5 feet 8 inches in height must measure 34 inches round the chest, and in like manner a recruit who is 5 feet 10 inches high must have a chest measurement of 35 inches.

A man wishing to re-enter the service is not to be considered ineligible, though he may be below the existing standard; but in the case of men discharged from cavalry, the regulations of height for heavy, medium, and light cavalry are to be adhered to.

## II.—ENLISTMENT, RE-ENGAGEMENT, AND EXTENSION OF ARMY SERVICE.

### Conditions of Service.

2. Recruits may be enlisted for long or short service in such proportions as may from time to time be directed by the adjutant-general for—

| | |
|---|---|
| I. Cavalry .. .. | *Long service*—i.e. for 12 years' army service; or,<br>*Short service*—i.e. for 8 years' army service and 4 years' reserve service. |
| II. Artillery .. .. | *Long service*—i.e. for 12 years' army service; or,<br>*Short service*—i.e. for 8 years' army service and 4 years' reserve service. |
| III. Engineers.. .. | *Long service*—i.e. for 12 years' army service; or,<br>*Short service*—i.e. for 8 years' army service and 4 years' reserve service. |
| IV. Infantry .. .. | *Long service*—i.e. for 12 years' army service; or,<br>*Short service*—i.e. for 6 years' army service and 6 years' reserve service. |
| V. Army service corps | *Long service*—i.e. for 12 years' army service; or,<br>*Short service*—i.e. for 6 years' army service and 6 years' reserve service. |
| VI. Army hospital corps | *Long service*—i.e. for 12 years' army service. |
| VII. Colonial corps .. | *Long service*—i.e. for 12 years' army service. |

3. Within such limits as may from time to time be prescribed, soldiers may, on the recommendation of their commanding officers, and with their own free assent, after 3 years' army service, pass to the reserve and complete in that force the unexpired portion of their engagement.

4. Until further orders, recruits may be enlisted for one or other of the several regiments, brigades, or corps specified below:—(*a*) cavalry and infantry regiments of household troops; (*b*) the royal regiment of artillery; (*c*) the corps of royal engineers; (*d*) cavalry regiments; (*e*) infantry brigades of subdistricts; (*f*) army service corps; (*g*) army hospital corps; (*h*) colonial regiments.

5. Recruits enlisted at the head-quarters of an infantry regiment must be enlisted for the subdistrict brigade to which the regiment belongs, and they will be liable to serve with either of the line battalions which compose the brigade; they cannot be transferred to serve in any other brigade without their own consent.

6. Recruits who are enlisted in a subdistrict may enlist either (*a*) for the brigade of the subdistrict in which they engage; (*b*) for a brigade belonging to any other subdistrict for which recruiting is open; (*c*) for any other corps for which recruiting is open.

7. Recruits, if they wish it, may also enlist for general service, in which case they will be posted to any infantry brigade, cavalry regiment, or corps of the arm of the service for which they enlist.

8. Recruits enlisted under the above conditions, when once posted to an infantry brigade, cavalry regiment, or corps, will not subsequently be liable to be transferred to any other brigade, regiment, or corps, without their own consent, except in the cases provided for by the 7th and 11th sections of the Army Enlistment Act, 1870; but this regulation will not apply to men enlisted for general service as schoolmasters in the corps of armourers, for the School of Musketry, or for the band of the Royal Military College.

9. Any soldier who, having enlisted subsequent to the Army Enlistment Act of 1870, shall have completed 11 years' army service, or 9 years in certain cases,

when ordered for foreign service, may, with the consent of his commanding officer or other competent military authority, be re-engaged for such a period as shall complete 21 years in her Majesty's service.

13. Soldiers enlisted for short service who are non-commissioned officers, musicians, artificers, or men likely to make good non-commissioned officers, may at any time after the expiration of the first 3 years' service in the army, if specially recommended, extend their army service to complete 12 years' service with the colours.

## III.—CHANGE IN THE MUTINY ACT RELATING TO THE ENROLMENT OF MEN IN THE ARMY RESERVE.

Any man hereafter enrolled in the army reserve, or any man who now being enrolled therein shall so consent, shall be at all times during and in respect of such period of enrolment subject to this act to the extent and in the manner following, that is to say: for any wilful neglect or disobedience by him of an order or regulation made by the secretary of state, under the provisions of any act then in force for the government or regulation of the army reserve, he may be tried and punished by court-martial as if he were a soldier serving with a regiment, or, at the discretion of the military authorities, may be brought before a justice acting for the county district, city, borough, or place, where he may come or be, and by such justice may be sentenced to imprisonment with hard labour for a period not exceeding three months; proof of the delivery of a notice issued by the military authorities at the then last registered place of abode of any man enrolled in the army reserve, or of the posting of a letter addressed to him at such place, shall in all cases, in the absence of proof to the contrary, be deemed to be sufficient evidence, whether before a court-martial or before a justice, that such notice was brought to his knowledge. Any man hereafter enrolled in the army reserve, or any man who now being enrolled therein shall so consent, who shall without reasonable cause absent himself on two occasions when by the acts governing such force or the regulations made or to be made by virtue thereof, he is duly ordered to be present at any place for the receipt of pay he shall be deemed a deserter: provided that nothing contained in this section shall be deemed to affect any liability to which a man enrolled in the army reserve may be at the time subject under the provisions of any other section of this act, or of any other act for the time being in force, or of any orders or regulations made in pursuance therof: provided also that nothing in the 15th section of the Army Enlistment Act, 1870, shall be deemed to affect the validity of any order of the secretary of state for the enrolment, re-enrolment, or prolongation of the service, with their own consent, of men in the army reserve at any age, and the proviso of such section is hereby repealed. Section 21 of the Army Enlistment Act, 1870, is hereby repealed so far as the same repeals section 8 of the Reserve Force Act, 1867.

# APPENDIX J.

## I.—GRATUITIES TO SOLDIERS ON DISCHARGE.

1. The general fund which has been formed from the fines inflicted upon soldiers for the crime of drunkenness is appropriated to the purpose of granting gratuities to well-conducted non-commissioned officers and men on discharge from the army.

2. The scale of gratuities will be regulated annually according to the state of the general fund, and will be notified to the army from time to time.

3. From the 1st January 1874, the issue of the gratuities will be regulated by the following rules, except that, in colonial corps, the rates of gratuity will be only half those fixed for the army generally.

4. Every soldier who shall be discharged otherwise than for misconduct will be paid, at the time of his discharge, a gratuity calculated at the rate of twenty shillings for each good-conduct badge then in his possession; provided that the total sum of £3 shall not be exceeded, except in the case of a soldier who may not, for the 10 years previous to his discharge, have been recorded as guilty of drunkenness. In such case the limit will be extended to £4 if the soldier shall be in possession of four good-conduct badges, and to £5 if he shall be in possession of five good-conduct badges.

5. In the case of a sergeant the amount issuable will be calculated on the number of badges to which his services and conduct would have entitled him, had he been a private soldier at the time of his discharge, subject to the above limits. The charge will be vouched by a certified record of service.

6. Men transferred from the line to the 1st-class army reserve, to complete their term of service, will receive at the time of such transfer such gratuities from the fund as they would have received had they been discharged in lieu of being transferred.

7. Such men, if allowed to rejoin the colours, will not be required to refund any portion of the amount so received. They will be paid on final discharge from the army a gratuity, at the rates specified above, for any badge or badges they may have become possessed of over and above those they had when transferred to the army reserve.

8. Non-commissioned officers detached from regiments of the line or other corps of the army, for service with the auxiliary forces, will not be entitled to receive these gratuities until they are finally discharged from the army.

## II.—GRATUITIES.

Instructions with respect to the royal warrant of the 14th August 1875, regulating good-conduct medals and gratuities, have been issued by the Commander-in-Chief. It is explained that that royal warrant is so far retrospective that all non-commissioned officers and men who had fulfilled the prescribed conditions, and who were serving on, or subsequent to, the 1st April last, are eligible to be recommended for the medal and gratuity of £5, without regard to the year in which they may have qualified. Applications, with the prescribed documents appended thereto, for medals with gratuity, are to be sent quarterly, viz. on the 1st April, 1st July, 1st October, and 1st January, to the adjutant-general of the forces, by commanding officers. The applications are to be enclosed in one covering letter, in the margin of which should appear the names of the soldiers recommended. Pars. 2 and 3, sect. 21, of the Queen's Regulations and Orders for the Army are accordingly modified. Sergeants and corporals who have been awarded medals under the old regulations, with partial gratuity, or the medal without gratuity, will receive or have the gratuity already awarded made up to £15, and £10, as the case may be, provided that, when recommended for the distinction, they had qualified for a sergeant's or corporal's full gratuity. Privates awarded medals without gratuity will be allowed £5 each. The names of these non-commissioned officers and men need not be again submitted by commanding officers, as the records at the Horse Guards will be sufficient to guide the issue of the gratuities to them on discharge from the service. In future the names of non-commissioned officers and men receiving the good-conduct medal will be published in general orders.

## III.—PENSIONS AND GRATUITIES TO THE PERMANENT STAFF OF THE YEOMANRY AND VOLUNTEERS.

### 1. PENSIONS.

1. Pensions at the rate of 5d. a day shall be granted to non-commissioned officers and trumpeters who shall have faithfully served for 20 years on the permanent staff of any regiment of yeomanry cavalry, and to sergeant instructors who shall have similarly served on the permanent staff of any administrative regiment or corps of the volunteer force of Great Britain, and who shall be discharged on account of age or infirmity.

2. Such service shall be exclusive of any period which the non-commissioned officer or trumpeter of yeomanry, or the sergeant-instructor of volunteers, may be entitled to reckon towards pension on discharge from the regular forces or towards increase of line pension, under the provisions of art. 1134 of the warrant of the 27th December 1870, or on account of which he may already have been granted a gratuity.

### 2. GRATUITIES.

3. A non-commissioned officer or trumpeter on the permanent staff of a regiment of yeomanry cavalry, or a sergeant instructor of volunteers, who may become medically unfit for further service, shall upon discharge receive a gratuity as follows:—

(*a*) For a service of not less than 7 years on the permanent staff, 90 days' pay.

(*b*) For a service of 14 years and upwards on the permanent staff, 180 days' pay.

4. Such service shall be exclusive of any period which the non-commissioned officer or trumpeter of yeomanry cavalry, or the sergeant instructor of volunteers, may be entitled to reckon towards pension or discharge from the regular forces, or towards increase of line pension, under the provisions of art. 1134 of the warrant of the 27th December 1870.

# APPENDIX K.

## I.—REGULATIONS TO BE OBSERVED IN THE EMPLOYMENT OF LAMPS FOR LIGHTING MAGAZINES, AMMUNITION STORES, LABORATORIES, AND THEIR PASSAGES.

1. On no account will any but the authorised lamps be used for the purpose of lighting magazines, ammunition stores, laboratories, and their passages.

2. Such lamps only will be lighted from time to time as the officer commanding may direct.

3. A magazine copper lantern will be used for the inspection of the ammunition stores and underground passages.

4. One or more men, as may be required, will be specially detailed as "lampmen" *for each work* to attend to all the lighting arrangements and stores connected therewith.

5. As all passage and wall lamps required for lighting the ammunition stores can be placed in position from the "light" passages, the lampmen will on no account pass beyond the junction of the "light" passages with the general passages.

6. When it is impossible to clean the glass of the light recess from the lamp passage, such glass must be cleaned by one of the magazine men from the inside. This in some cases may necessitate the unscrewing and removing the frame; if so, care will be taken that it is properly replaced. This operation should be effected in the presence of the officer or non-commissioned officer in charge.

7. All lamps, when not in use, will be kept in the lamp room.

8. A copy of these instructions attached to a board will be hung up in each lamp room. Copies for this purpose, printed on foolscap paper, can be obtained on demand.

9. Should any special instructions be required in any particular work for the guidance of the lampmen in the management of any peculiar lamp recesses, they should be added in manuscript.

## II.—GENERAL INSTRUCTIONS FOR THE GUIDANCE OF THE ROYAL ARTILLERY IN CHARGE OF MAGAZINES OR AMMUNITION STORES.

1. No one will pass the barrier at the entrance of a magazine or ammunition store except in the presence of the officer, master gunner, or non-commissioned officer in local charge of the building, who will be responsible that all persons entering comply with the necessary precautions, and that they have no articles of a combustible nature in their possession.

2. All persons employed in magazines, cartridge stores, and in shell stores when connected with cartridge stores, will, before entering the same, change their own clothes and boots for magazine clothing and slippers. This will be effected in the place appointed for shifting, where the boots and clothing taken off will be deposited.

3. Smoking is strictly prohibited near any magazine or ammunition store, and

any soldier entering them with a pipe or lucifer match in his possession will be made a prisoner.

4. Only the hand magazine lantern will be used within the magazine or ammunition stores, and then only in the presence of the person in actual charge.

5. Laboratory operations will not be carried on in any magazine, cartridge, or shell store, or in any of the passages connected therewith, but only in the building, or tent, specially provided for the purpose (*vide* Regulations for Laboratories).

6. Every favourable opportunity will be taken for airing the magazines on the principles given in the memorandum under the head of Powder Magazine. Common thermometers will be issued to all magazines containing 100 barrels and upwards of loose powder.

7. Magazines will never be left open unguarded, and sentries will be particularly attentive to the earliest appearance of a storm, however distant; and upon hearing thunder, or seeing a flash of lightning, they will give the necessary notice, in order that the doors and ventilators may be immediately closed.

8. The floor of a magazine or ammunition store will be kept scrupulously clean and free from loose grains of powder. The passages will be covered with hides, wadmiltilts, or hair-cloths, when powder in bulk is being moved; these coverings should be frequently lifted and dusted.

9. Barrels, cylinders, and cases will be placed so that the air can circulate freely round them. They should be at least 6 inches from the masonry of the building.

10. No packing or shifting of cartridges, or issue of powder from cases or barrels, will be permitted within the block containing the magazine or cartridge stores. These operations will only be carried on in the laboratory.

11. No friction, detonating or common tubes, fuzes, quick or slow match, signal lights, rockets or primers, will be kept in any magazine or cartridge store, or admitted within the enclosure of a magazine where gunpowder alone is stored. Tubes and fuzes may be kept in the shell stores.

12. Small-arm ammunition, which contains its own means of ignition, will not be stowed in the same chamber of a magazine with gunpowder, whether the latter is loose or in filled cartridges.

13. Oiled rags, cotton waste, oakum, or cloths for cleaning are not to be kept in magazines, ammunition stores, or their passages.

14. All boxes, cases, and barrels placed in magazines or ammunition stores will be labelled, and no empty boxes, cases, or barrels will be allowed to remain in them. Barrels containing powder will never be rolled along the floors of magazines or passages, but will be carefully transported from one place to another.

15. Officers, master gunners, and non-commissoned officers in charge, will at all times be particularly careful with everything in or about the magazines, and will take immediate notice of any irregularity they may observe. They will also be very prompt in reporting any defects or repairs necessary either to the interior or exterior of the buildings.

16. An inventory board, showing the contents of the magazine or ammunition store, will be hung up in the lobby or passage leading thereto.

17. The keys of the magazines and ammunition stores will be labelled, and, when not in use, deposited in a secure place.

18. A copy of these instructions attached to a board will be hung up on the inside of outer doors and on the wall of the entrance to the magazines. Copies for this purpose, printed on foolscap paper, can be obtained on demand.

19. W.O. Form 939 (Standing Orders for Artillery Magazines, dated Horse Guards, 1st December 1865) has been cancelled.

# APPENDIX L.

## MEDALS.

1. Military decorations and medals are to be worn with the tunic only, and on the left breast. They are to be worn in a straight horizontal line, suspended from a single bar, of which the buckle is not to be seen. The riband is not to exceed 1 inch in length, unless the number of clasps requires it to be longer. When the decorations and medals cannot, on account of the number, be suspended from the bar so as to be fully seen, they are to overlap. They are to be worn over the sash and under the pouch-belt.

2. Military medals will be worn in the order of the dates of the campaigns for which they have been conferred; the first decoration or medal obtained being placed farthest from the left shoulder.

The following is the order of arrangement:—

1. English decorations.
2. English medals.
3. Foreign decorations.
4. Foreign medals.

3. Military medals granted to non-commissioned officers and men may also be worn as indicated in the foregoing paragraphs, or they may be stitched, in a straight horizontal line, on the tunic. In undress uniform the ribands only are to be worn by soldiers. They should be stitched on the jacket, and must be ½ inch in length.

4. The rules contained in pars. 5 and 6, sect. 12, of the Queen's Regulations and Orders for the Army remain unaltered, except that the miniature orders and medals worn by officers must be suspended from a bar, as in the case of military decorations and medals.

5. The bar for the suspension of decorations and medals is in all cases to be provided at the expense of the wearer. It may be of any metal or material, and of any pattern consistent with the above instructions, provided the bar and the buckle are wholly concealed by the ribands.

6. Medals awarded by a society for bravery in saving human life are, if specially authorised, to be worn on the right breast.

---

The following rules to govern the wearing of medals and decorations will in future be strictly adhered to by all branches of the auxiliary forces:—

1. Medals and decorations given by the Queen or by a foreign sovereign, the acceptance of which has been sanctioned by her Majesty, will be worn on the left breast. Medals awarded by a society for bravery in saving human life will be worn on the right breast. No other medals or decorations will be worn by the *militia*, yeomanry, or volunteer forces in uniform.

2. No decoration or medal given by a foreign sovereign may be worn unless her Majesty's permission to accept and wear it has been granted. The regulations regarding foreign orders and medals issued by the Foreign Office will be strictly adhered to.

# APPENDIX M.

## I.—STANDARD WEIGHTS AND MEASURES OF GREAT BRITAIN AND HER COLONIES.

### The Imperial Measures, introduced January 1, 1862.

*Avoirdupois or Commercial Weight.*

| | | Mark. |
|---|---|---|
| 0·10831 cubic inch of pure water, at 62° Fahrenheit, or 27·34375 grains troy .. .. .. | = 1 dram, | *dr.* |
| 16 drams .. .. .. .. .. .. | = 1 ounce, | *oz.* |
| 16 ounces .. .. .. .. .. .. | = 1 pound, | *lb.* |
| 14 pounds .. .. .. .. .. .. | = 1 stone, | *st.* |
| 2 stones, or 28 pounds .. .. .. .. | = 1 quarter, | *qr.* |
| 4 quarters, or 112 pounds .. .. .. .. | = 1 hundredweight, | *cwt.* |
| 20 hundredweights, or 2240 pounds .. .. | = 1 ton, | *T.* |

*Note.*—The stone is principally used in weighing hay, straw, and live cattle, and commonly called *jockey weight.*

*Troy Weight.*

Is used in weighing gold, silver, and precious stones, and also in estimating the results of philosophical experiments. Small-arm cartridges are also weighed by troy weight.

| | | Mark. |
|---|---|---|
| 1·901306 cubic inch of pure water, at 62° Fahrenheit .. .. .. .. .. .. .. | = 480 grains, | *gr.* |
| 24 grains .. .. .. .. .. .. | = 1 pennyweight, | *dwt.* |
| 20 pennyweights .. .. .. .. .. | = 1 ounce, | *oz.* |
| 12 ounces .. .. .. .. .. .. | = 1 pound, | *lb.* |

*Note.*—Avoirdupois lbs. × 1·21528 = troy lbs.
„ oz. × ·9115 = „ oz.
Troy lbs. × ·823 = avoirdupois lbs.
„ oz. × 1·1 = „ oz.
„ grs. × ·03657 = „ drs.

*Lineal Measures, or Measures of Length.*

7·92 inches .. .. .. .. .. = 1 link.
12 „ .. .. .. .. .. = 1 foot.
3 feet .. .. .. .. .. .. = 1 yard.
6 „ .. .. .. .. .. .. = 1 fathom.
16½ „ or 5½ yards .. .. .. .. = 1 rod, pole, or perch.
792 inches .. .. .. .. .. }
66 feet .. .. .. .. .. .. } = 1 chain.
22 yards, or 4 poles .. .. .. .. }
220 yards .. .. .. .. .. .. }
*40, poles, or* .. .. .. .. .. } = 1 furlong.
*10 chains* .. .. .. .. .. }

20

5280 feet .. .. .. .. .. ..
1760 yards .. .. .. .. .. ..
320 poles .. .. .. .. .. .. = 1 statute mile.
80 chains, or .. .. .. .. ..
8 furlongs .. .. .. .. ..
6082·6 feet, or .. .. .. .. ..
2027·5 yards .. .. .. .. .. = 1 nautical mile.

*Square or Superficial Measures.*

144 square inches .. .. .. .. = 1 square foot.
9 „ feet .. .. .. .. .. = 1 „ yard.
272¼ „ feet, or .. .. .. ..
30¼ „ yards .. .. .. .. = 1 pole or perch.
40 poles .. .. .. .. .. .. = 1 rood.
4840 square yards, or .. .. .. ..
10 „ chains .. .. .. .. = 1 acre.
640 acres .. .. .. .. .. .. = 1 square mile.

*Cubic Measures, or Measures of Solidity and Capacity.*

1728 cubic inches .. .. . .. .. = 1 cubic foot.
27 „ feet . .. .. .. .. .. = 1 „ yard.
5 „ feet .. .. .. .. .. = 1 barrel bulk of shippi
42 „ feet .. .. .. .. .. = 1 ton of shipping.
A load of unhewn timber .. .. .. .. = 40 cubic feet.
„ squared „ .. .. .. .. = 50 „
A cord of wood .. .. .. .. .. = 128 „

---

## II.—FOREIGN WEIGHTS AND MEASURES.

### AUSTRIA.

*Money.*

Florin, or Gulden, of 100 Neukreuzer .. .. = about 2s.
Golden crown of 8 florins .. .. .. .. = „ 15s. 11d.

The chief medium of exchange is a paper currency consisting of banknot from 1000 florins down to 1 florin.

*Weights and Measures.*

Centner = 100 Pfund .. .. .. = 123½ lbs. avoirdupois.
Eimer .. .. .. .. .. = 14·94 wine gallons.
Joch .. .. .. .. .. = 1·43 acre.
Metze .. .. .. .. .. = 1·7 imperial bushel.
Klafter .. .. .. .. .. = 67 cubic feet.
Meile = 24,000 Austrian feet .. .. = 8297 yards, or about 4¾ miles.

### DENMARK.

*Money.*

By a law which came into force on January 1875, the decimal currency w introduced in Denmark, the unit being the *krōna* (crown). The *krōna* generally accounted of one-half the value of the old unit currency, of which took the place, the *rigsdaler*.

Kröna = 100 öre = 1s. 1⅓d. or about 18 kröner to £1 sterling.

### *Weights and Measures.*

Lod .. .. .. .. .. = 227 grains troy.
Pound .. .. .. .. .. = 1·102 avoirdupois.
Ship last .. .. .. .. = 2 tons.
Tönde, for grain and salt .. .. = 3·8 imperial bushels.
„ for coal .. .. .. = 4·7 „
Foot .. .. .. .. .. = 1·03 foot.
Viertel .. .. .. .. = 1·7 imperial gallon.

## FRANCE.

### *Money.*

Franc of 100 centimes = 10d.

### *Measures of Length.*

| Systematic Names. | French Value. | English Value. |
|---|---|---|
| Myriamètre | 10,000 mètres | 6·2138 miles. |
| Kilomètre | 1,000 „ | 1093·633 (⅝ mile.) |
| Décamètre | 10 „ | 10·93633 yards. |
| *Mètre* | Fundamental unit of weights and measures * | 1·094 yard, 3·281 feet, or 39·372 inches. |
| Décimètre | $\frac{1}{10}$ mètre | 3·9372 inches. |
| Centimètre | $\frac{1}{100}$ „ | 0·3937 inch. |
| Millimètre | $\frac{1}{1000}$ „ | 0·03937 „ |

### *Superficial Measures.*

| | | |
|---|---|---|
| Hectare | 10,000 square mètres | 2·4711 acres. |
| *Are* | 100 „ | 0·09884 rood. |
| Centiare | 1 „ | 1·19603 square yard. |

### *Measures of Capacity.*

| | | |
|---|---|---|
| Kilolitre | 1 cubic mètre, or 1000 cubic décimètres | 220·096 gallons. |
| Hectolitre | 100 cubic decimètres | 22·00967 „ |
| Décalitre | 10 „ | 2·200967 „ |
| *Litre* | 1 cubic décimètre | 0·220097 gallon or<br>1·7607 pint. |
| Décilitre | $\frac{1}{10}$ „ | 0·17608 „ |

### *Measures of Solidity.*

| | | |
|---|---|---|
| *Stère* | 1 cubic mètre | 35·316 cubic feet. |
| Décistère | $\frac{1}{10}$ „ | 3·53166 „ |

### *Weights.*

| | | |
|---|---|---|
| Millier | 1000 kilogrammes, or 1 French ton | 19·7 cwt. |
| Quintal | 100 kilogrammes | 1·97 cwt. |
| Kilogramme | 1000 grammes, weight of 1 cubic décimètre of water | 2·26793 lb. troy, or<br>2·2046 lbs. avoirdupois. |
| Hectogramme | 100 grammes | 3·2 oz. troy, or<br>3 oz. 3·53 drs. avoirdupois. |
| Décagramme | 10 „ | 5·75 drs. avoirdupois, or<br>154·328 grains troy. |

---

* The ten-millionth part of the spherical distance of the Pole from the Equator; it was ascertained by measuring an arc of the meridian between the parallels of Dunkirk and Barcelona.

202

### TURKEY.

*Money.*

Lira, or gold medjidie .. .. .. .. = 18s. 0·64d.
Piastre, 100 to the lira .. .. .. .. = 2·16d.
„ or becklik, 105 to the lira .. .. = 2·06d.
„ or copper, 110 to the lira .. .. = 1·97d.

*Weights and Measures.*

Oke .. .. .. = 100 drams = 2·83 lbs. avoirdupois.
Almud .. .. .. = 1·51 gallon.
Killow .. .. .. = 0·912 bushel.
Cantar .. .. .. = 44 okes = 125 lbs. avoirdupois.
Tcheké .. .. .. = 180 okes = 511·38 lbs.
Kilo .. .. .. = 20 okes = 0·36 quarter.
816 kilos .. .. = 100 quarters.
Andanzé (cloth) .. = 27 inches.
Archin (land) .. = 30 „
Donum (land) .. .. = 40 square paces.

---

# APPENDIX N.

## PASSAGE WARRANT.

1. The weight of personal baggage to be ordinarily conveyed at the publ expense, by land or sea, at home or abroad, except when on service in the fiel shall be regulated by the following scales :—

### OFFICERS.

*Staff and Departmental Rank or Relative Army Rank.*

| | Cwt. |
|---|---|
| General | 40 |
| Lieutenant-general | 36 |
| Major-general | 36 |
| Brigadier-general | 30 |
| Colonel | 30 |
| Lieutenant-colonel | 20 |
| Major | 18 |
| Captain | 12 |
| Lieutenant | 12 |
| Sub-lieutenant | 12 |

*Regimental Rank or Relative Army Rank.*

| | Cwt. |
|---|---|
| Colonel | 25 |
| Lieutenant-colonel | 18 |
| Major | 15 |
| Captain | 10 |
| Lieutenant | 9 |
| Sub-lieutenant | 9 |

2. Officers of our royal engineers, and medical officers, shall be permitted to carry 2 cwt., and superintending schoolmasters 1 cwt. in addition to the weight allowed by art. 1.

3. All mounted officers, when proceeding by water, shall be entitled to an additional allowance for horse equipment of—

> 2 cwt. for one horse, and 1 cwt. for each additional horse, for which forage at the public expense is provided.

4. When proceeding by sea, if their passage is provided at the public expense, the families of officers shall be allowed to embark with them the following additional weight of baggage:—

| | Cwt. |
|---|---|
| Each officer's wife, together with his children under 14 years of age | 6 |
| Each son exceeding 14 and under 16 years of age .. .. .. | ½ |
| Each unmarried daughter exceeding 14 years of age .. .. | ½ |

5. Officers who entered our late store service before the 1st January 1857, and officers who held the appointment of barrack-master before the 7th February 1860, shall be allowed to have their furniture conveyed according to the following scale:—

| Rank or Appointment. | Limit of Weight Allowed. Cwt. |
|---|---|
| For an officer above the relative army rank of captain, an allowance not exceeding .. .. .. .. .. | 60 |
| For his wife .. .. .. .. .. .. .. | 20 |
| For his children .. .. .. .. .. .. | 20 |
| For an officer of the relative rank of captain, an allowance not exceeding .. .. .. .. .. .. | 40 |
| For his wife .. .. .. .. .. .. .. | 15 |
| For his children .. .. .. .. .. .. | 15 |
| For an officer of the relative rank of subaltern, an allowance not exceeding .. .. .. .. .. | 30 |
| For his wife .. .. .. .. .. .. .. | 10 |
| For his children .. .. .. .. .. .. | 10 |

In addition to the quantity of baggage allowed to each such officer according to his rank by art. 1, he shall be allowed:—

| | Cwt. |
|---|---|
| For his wife and such of his children as may be under 14 years of age .. .. .. .. .. .. .. | 6 |
| For each son exceeding 14 and under 18 years of age .. | ½ |
| For each unmarried daughter exceeding 14 years of age .. | ½ |

6. The weight of baggage prescribed by the scale laid down in art. 1, for which officers shall be allowed the cost of carriage, when travelling upon the public service, shall be inclusive of the quantity carried free by railway or other conveyance.

7. Officers travelling on the public service at home, when not required to take their heavy baggage, shall only be allowed conveyance for 1 cwt., which quantity is carried free of charge by railway companies.

8. At foreign stations the quantity of baggage, not exceeding that prescribed by arts. 1 and 2, which officers proceeding on temporary duty may take with them shall be regulated by the general or other officer commanding, in accordance with the requirements of the service at the station.

9. Officers, while on leave from one station, when ordered to rejoin at another, shall, if they have left their heavy baggage at the one station, be allowed the cost of its transport to the station at which they are ordered to rejoin; but no compensation shall be granted for damage to, or loss of, baggage so conveyed.

### NON-COMMISSIONED OFFICERS AND MEN.

10. The weight of personal baggage to be conveyed for non-commissioned officers and men of our army and its departments, under the conditions contained in art. 1, shall be as follows:—

*Class I.*

| | |
|---|---|
| Staff and departmental .. .. | 2 cwt. each, and 1 cwt. additional if married. |
| Regimental, or attached to regiments | 2 cwt. each, married or unmarried. |

*Classes II. and III.*

| | |
|---|---|
| Staff and departmental .. .. | 1 cwt. each, and 1 cwt. additional if married. |
| Regimental .. .. .. .. | ½ cwt. each, and 1 cwt. additional if married. |

For each family on married establishment of rank and file, 1 cwt.

Schoolmasters and schoolmistresses 1 cwt. each additional for books.

11. The weights specified in art. 10 shall be conveyed at home irrespective of the 56 lbs. carried free for each passenger by a railway company.

### STORES.

12. The weight of stores to be conveyed for the different corps in the service shall be as follows:—

*For a Regiment of Cavalry and Infantry.*

| | Cwt. | |
|---|---|---|
| Quartermaster (including signalling stores and artificers' tools) .. | 2 | Actual weight.<br>For books. |
| Paymaster .. .. .. .. | 5 | or 8 if attestations are conveyed. |
| Orderly room .. .. .. | 8 | |
| Hospital .. .. .. .. | 18 | When necessarily conveyed. |
| Armourer .. .. .. .. | 2 | |
| Shoemaker .. .. .. .. | 2 | |
| Band .. .. .. .. | 12 | |
| Recreation room .. .. .. | 5 | |
| Officers' mess .. .. .. | 50 | |
| Sergeants' mess .. .. .. | 15 | |
| School .. .. .. .. | 4 | |

*Special to Cavalry.*

| | Cwt. | |
|---|---|---|
| Riding-master .. .. .. | 1 | |
| Saddler, farrier, and saddle-tree maker .. .. .. .. | 1 | Each. |
| Arm-chests .. .. .. .. | 12 | Each troop, and 1½ cwt. additional for every 10 men over 60 per troop. |

### *Special to Infantry.*

| | Cwt. | |
|---|---|---|
| Arm-chests .. .. .. .. | 18 | Each company, and 1½ cwt. additional for every 10 men over 60 per company. |

### *Royal Artillery.*

| | Cwt. | |
|---|---|---|
| Quartermaster .. .. .. | | Actual weight. |
| | 2 | For books. |
| Paymaster .. .. .. .. | 5 | or 8 if attestations are conveyed. |
| Riding-master .. .. .. | 1 | |
| Orderly room .. .. .. | 8 | For each brigade. |
| Armourer .. .. .. .. | 2 | For head-quarters. |
| Shoemaker .. .. .. .. | 2 | |
| Hospital .. .. .. .. | 5 | For each battery, when necessarily conveyed. |
| Arm-chests .. .. .. .. | | Same as for cavalry and infantry. |
| Officers' mess .. .. .. | 9 | For each battery. |
| Sergeants' mess .. .. .. | 3 | ” |

### *Royal Engineers and Army Service Corps.—For each Troop or Company.*

| | Cwt. | |
|---|---|---|
| Quartermaster, viz. spare necessaries, deserters' kits, &c. .. | | Actual weight. |
| Hospital .. .. .. .. | | Actual weight when necessarily conveyed. |
| For arm-chests, accoutrement chests, stationery chest, &c. .. .. | 18 | And 1½ cwt. additional for every 10 men over 60 per troop or company. |

### TRAVELLING EXPENSES.—MARRIED ESTABLISHMENT.

13. Free conveyance shall in future be provided at the regulated rates for the families of all soldiers on the married establishment.

# APPENDIX O.

## I.—TABLE OF INDIAN PAY AND ALLOWANCES.*

| Monthly. | | Pay and Indian Allowance. | | | Regimental House Rent. | | | Horse Allowance. | | | Tentage. | | | Extra Batta. | | | Total. | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | R. | A. | P. | R. | A. | P. | R. | A. | P. | R. | A. | P. | R. | A. | P. | R. | A. | P. |
| COLONEL. | | | | | | | | | | | | | | | | | | | |
| Horse artillery, and cavalry .. .. | In garrison | 1158 | 7 | 0 | 0 | 0 | 0 | 120 | 0 | 0 | 200 | 0 | 0 | 0 | 0 | 0 | 1478 | 7 | 0 |
| | In the field | 1158 | 7 | 0 | 0 | 0 | 0 | 120 | 0 | 0 | 200 | 0 | 0 | 0 | 0 | 0 | 1478 | 7 | 0 |
| Foot artillery, engineers, European and native infantry .. .. .. | In garrison | 1065 | 5 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 200 | 0 | 0 | 0 | 0 | 0 | 1295 | 5 | 0 |
| | In the field | 1065 | 5 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 200 | 0 | 0 | 0 | 0 | 0 | 1295 | 5 | 0 |
| LIEUTENANT-COLONEL. | | | | | | | | | | | | | | | | | | | |
| Horse artillery, and cavalry .. .. | In garrison | 582 | 10 | 0 | 100 | 0 | 0 | 120 | 0 | 0 | 150 | 0 | 0 | 0 | 0 | 0 | 952 | 10 | 0 |
| | In the field | 582 | 10 | 0 | 0 | 0 | 0 | 120 | 0 | 0 | 150 | 0 | 0 | 304 | 6 | 0 | 1157 | 0 | 0 |
| Foot artillery, engineers, European and native infantry * .. .. .. | In garrison | 547 | 14 | 0 | 100 | 0 | 0 | 30 | 0 | 0 | 150 | 0 | 0 | 0 | 0 | 0 | 827 | 14 | 0 |
| | In the field | 547 | 14 | 0 | 0 | 0 | 0 | 30 | 0 | 0 | 150 | 0 | 0 | 304 | 6 | 0 | 1032 | 4 | 0 |
| MAJOR. | | | | | | | | | | | | | | | | | | | |
| Horse artillery, and cavalry .. .. | In garrison | 461 | 1 | 10 | 80 | 0 | 0 | 120 | 0 | 0 | 120 | 0 | 0 | 0 | 0 | 0 | 781 | 1 | 10 |
| | In the field | 461 | 1 | 10 | 0 | 0 | 0 | 120 | 0 | 0 | 120 | 0 | 0 | 228 | 4 | 6 | 929 | 6 | 4 |
| Foot artillery,† engineers, European and native infantry .. .. .. | In garrison | 410 | 14 | 6 | 80 | 0 | 0 | 30 | 0 | 0 | 120 | 0 | 0 | 0 | 0 | 0 | 640 | 14 | 6 |
| | In the field | 410 | 14 | 6 | 0 | 0 | 0 | 30 | 0 | 0 | 120 | 0 | 0 | 228 | 4 | 6 | 789 | 3 | 0 |
| CAPTAIN. | | | | | | | | | | | | | | | | | | | |
| Horse artillery, and cavalry .. .. | In garrison | 306 | 11 | 4 | 50 | 0 | 0 | 90 | 0 | 0 | 75 | 0 | 0 | 0 | 0 | 0 | 521 | 11 | 4 |
| | In the field | 306 | 11 | 4 | 0 | 0 | 0 | 90 | 0 | 0 | 75 | 0 | 0 | 91 | 5 | 0 | 563 | 0 | 4 |
| Engineers, and foot artillery‡ .. .. | In garrison | 267 | 5 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 75 | 0 | 0 | 0 | 0 | 0 | 392 | 5 | 0 |
| | In the field | 267 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 75 | 0 | 0 | 91 | 5 | 0 | 433 | 10 | 0 |
| European and native infantry .. .. | In garrison | 249 | 1 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 75 | 0 | 0 | 0 | 0 | 0 | 374 | 1 | 0 |
| | In the field | 249 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 75 | 0 | 0 | 91 | 5 | 0 | 415 | 6 | 0 |

| | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **LIEUTENANT.** | | | | | | | | | | | | | | | | | | | |
| Horse artillery, and cavalry .. .. | In garrison | 194 | 6 | 0 | 30 | 0 | 0 | 60 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 334 | 6 | 0 |
| | In the field | 194 | 6 | 0 | 0 | 0 | 0 | 60 | 0 | 0 | 50 | 0 | 0 | 60 | 14 | 0 | 365 | 4 | 0 |
| Foot artillery, and engineers ‡ .. .. | In garrison | 154 | 14 | 0 | 30 | 0 | 0 | 25 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 234 | 14 | 0 |
| | In the field | 154 | 14 | 0 | 0 | 0 | 0 | 45 | 10 | 6 | 50 | 0 | 0 | 60 | 14 | 0 | 265 | 12 | 0 |
| European and native infantry .. .. | In garrison | 145 | 12 | 0 | 30 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 225 | 12 | 0 |
| | In the field | 145 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 60 | 14 | 0 | 256 | 10 | 0 |
| **JUNIOR LIEUTENANT.** | | | | | | | | | | | | | | | | | | | |
| Horse artillery, and sub-lieutenant of cavalry .. .. .. .. .. .. | In garrison | 154 | 15 | 10 | 25 | 0 | 0 | 60 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 289 | 15 | 10 |
| | In the field | 154 | 15 | 10 | 0 | 0 | 0 | 60 | 0 | 0 | 50 | 0 | 0 | 45 | 10 | 6 | 310 | 10 | 4 |
| Foot artillery, and engineers .. .. | In garrison | 117 | 10 | 6 | 25 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 192 | 10 | 6 |
| | In the field | 117 | 10 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 45 | 10 | 6 | 213 | 5 | 0 |
| **SUB-LIEUTENANT.** | | | | | | | | | | | | | | | | | | | |
| European and native infantry .. .. | In garrison | 107 | 1 | 11 | 25 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 0 | 0 | 0 | 182 | 1 | 11 |
| | In the field | 107 | 1 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | 0 | 0 | 45 | 10 | 6 | 202 | 12 | 5 |
| Surgeons as captains. | | | | | | | | | | | | | | | | | | | |
| Assistant surgeons as lieutenants. | | | | | | | | | | | | | | | | | | | |

---

* Regimental house rent, tentage, and extra batta, are now no longer shown under separate heads in drawing up pay bills, all being included under *Pay and Indian Allowance*, although shown separately in this table.

Officers of the Indian army not belonging to the staff corps receive same pay as officers of a British regiment.

† A major of artillery in command of a field battery receives 90 rupees per mensem horse allowance.

‡ Captains and lieutenants of foot artillery, when attached to field batteries, receive horse allowance.

## STAFF CORPS.

| | *In India.* | | | | *Out of India.* | | | | *Presidency House Rent.* |
|---|---|---|---|---|---|---|---|---|---|
| | R. | A. | P. | | £ | s. | d. | | R. |
| General officers .. .. .. .. .. | 1295 | 5 | 0 | per mensem, | 1 | 5 | 0 | per diem. | — |
| Brevet colonel and lieutenant-colonel .. .. | 827 | 14 | 0 | „ | 1 | 0 | 0 | „ | 125 |
| Major .. .. .. .. .. .. .. | 640 | 14 | 10 | „ | 0 | 16 | 0 | „ | 100 |
| Captain .. .. .. .. .. .. .. | 374 | 1 | 6 | „ | 0 | 10 | 6 | „ | 75 |
| Lieutenant .. .. .. .. .. .. | 225 | 12 | 0 | „ | 0 | 6 | 6 | „ | 40 |

## II.—TABLE OF SALARIES ALLOWED FOR STAFF OFFICERS AND DEPARTMENTS OF THE SEVERAL PRESIDENCIES IN INDIA.

*(The chief departments alone have been inserted.)*

| | R. | |
|---|---|---|
| MILITARY SECRETARIATS. | | |
| Secretary to government of India, military department .. .. | 3500 | Consolidated. |
| ,, ,, Madras, military department .. .. | 2500 | |
| ,, ,, Bombay, military department .. .. | 2500 | |
| Deputy secretary to government of India, military department .. | 1000 | With staff corps pay of rank. |
| ,, ,, ,, Madras, military department .. | 800 | |
| ,, ,, ,, Bombay, military department .. | 800 | |
| First assistant secretary to government of India, military department .. .. .. .. .. .. .. .. .. .. | 700 | |
| Other assistant secretaries, military department .. .. .. | 500 | |
| ADJUTANT-GENERAL'S DEPARTMENT. | | |
| Adjutant-general in India .. .. .. .. .. .. .. .. | 3000 | Consolidated. |
| ,, ,, Madras .. .. .. .. .. .. .. .. | 2200 | |
| ,, ,, Bombay .. .. .. .. .. .. .. | 2200 | |
| Deputy adjutant-general, Bengal .. .. .. .. .. .. .. | 1000 | With staff corps pay of rank. |
| ,, ,, ,, Madras .. .. .. .. .. .. .. | 800 | |
| ,, ,, ,, Bombay .. .. .. .. .. .. | 800 | |
| First assistant adjutant-general at army head-quarters, Bengal .. | 600 | |
| Assistant adjutant-general at army head-quarters, Madras .. .. | 600 | |
| ,, ,, ,, Bombay .. .. | 600 | |
| ,, ,, ,, Bengal .. .. | 500 | |
| Deputy assistant adjutant-general at army head-quarters, Bengal .. | 500 | |
| Deputy adjutant-general, R.A., in India .. .. .. .. .. | 800 | |
| Assistant adjutant-general (for musketry) .. .. .. .. | 600 | |
| QUARTERMASTER-GENERAL'S DEPARTMENT. | | |
| Quartermaster-general, Bengal .. .. .. .. .. .. .. | 2500 | Consolidated. |
| ,, ,, Madras .. .. .. .. .. .. .. | 2200 | |
| ,, ,, Bombay .. .. .. .. .. .. .. | 2200 | |
| Deputy quartermaster-general, Bengal .. .. .. .. .. .. | 1000 | With staff corps pay of rank. |
| ,, ,, Madras .. .. .. .. .. .. | 800 | |
| ,, ,, Bombay .. .. .. .. .. .. | 800 | |
| First assistant quartermaster-general, Bengal .. .. .. .. | 600 | |
| Assistant quartermasters-general (all presidencies) .. .. .. | 500 | |
| Deputy assistant quartermasters-general (all presidencies) .. .. | 400 | |
| JUDGE ADVOCATE-GENERAL'S DEPARTMENT. | | |
| Judge advocate-general .. .. .. .. .. .. .. .. .. | 2400 | Consolidated. |
| Deputy judge advocate-general, Bengal .. .. .. .. .. .. | 1200 | With staff corps pay of rank. |
| ,, ,, ,, Madras .. .. .. .. .. .. | 1000 | |
| ,, ,, ,, Bombay .. .. .. .. .. .. | 1000 | |
| ,, ,, advocates of divisions (all presidencies) .. .. | 500 | |
| DIVISIONAL STAFF. | | |
| General officers commanding divisions .. .. .. .. .. .. | 3500 | Consolidated. |
| Assistant adjutants-general of divisions .. .. .. .. .. .. | 500 | With staff corps pay of rank. |
| BRIGADE STAFF. | | |
| Brigadier-general, 1st class (all presidencies) .. .. .. .. .. | 1400 | With staff corps pay of rank. |
| ,, 2nd class (all presidencies) .. .. .. .. .. | 1200 | |
| Brigade majors (all presidencies) .. .. .. .. .. .. | *400 | |
| CHIEF AND DISTRICT INSPECTORS OF MUSKETRY. | | |
| Chief inspector of musketry, Bengal .. .. .. .. .. .. | 600 | With staff corps pay of rank. |
| ,, ,, Madras .. .. .. .. .. .. | 400 | |
| ,, ,, Bombay .. .. .. .. .. .. | 400 | |
| District inspectors of musketry (all presidencies) .. .. .. | 300 | With regimental pay of rank. |

---

* At Madras and Hyderabad the brigade majors receive 500 rupees.

## TABLE OF SALARIES ALLOWED FOR STAFF OFFICERS AND DEPARTMENTS OF THE SEVERAL PRESIDENCIES IN INDIA—*continued.*

| | R. | |
|---|---|---|
| ACCOUNT BRANCH, MILITARY DEPARTMENT. | | |
| Accountant-general | 2250 | Consolidated. |
| Deputy accountant-general | 1500 | |
| Controller of military accounts, Bengal | 2500 | |
| „ „ Madras | 2200 | |
| „ „ Bombay | 2200 | |
| 1st examiner, pay department, Bengal | 800 | With staff corps pay of rank. |
| 2nd examiner, pay department, Bengal | 600 | |
| Examiner, pay department, Madras | 800 | |
| „ „ Bombay | 800 | |
| „ commissariat accounts, Bengal | 1000 | |
| „ „ „ Madras | 900 | |
| „ „ „ Bombay | 900 | |
| „ ordnance accounts (all presidencies) | 500 | |
| PAY DEPARTMENT. | | |
| Presidency paymaster, Bengal | 800 | |
| „ „ Madras | 700 | |
| „ „ Bombay | 700 | |
| Paymaster of circles (all presidencies) | 600 | |
| Superintendent of family payments and pensions, Madras | 600 | |
| Deputy paymasters, Bengal | 300 | |
| Pension paymaster, Bombay | 350 | |
| „ „ out-stations | 250 | |
| Assistants, pay department, Bengal, at the presidency | 200 | With regimental or staff corps pay of rank. |
| „ „ out-stations | 150 | |
| COMMISSARIAT DEPARTMENT. | | |
| Commissary-general, Bengal | 2500 | Consolidated. |
| „ „ Madras | 2200 | |
| „ „ Bombay | 2200 | |
| Deputy commissaries-general, Bengal | 1000 | With staff corps pay of rank. |
| „ „ Madras | 900 | |
| „ „ Bombay | 900 | |
| Assistant commissaries-general, 1st class (all presidencies) | 800 | |
| „ „ 2nd class (all presidencies) | 600 | |
| Deputy assistant commissaries-general, 1st class | 500 | |
| „ „ „ 2nd class | 400 | |
| Sub-assistant commissaries-general, 1st class | 300 | |
| „ „ 2nd class | 200 | |
| „ „ 3rd class | 100 | |
| STUD DEPARTMENT. | | |
| Superintendent of studs, Bengal | 1000 | With staff corps pay of rank. |
| Deputy superintendent of studs, Bengal | 700 | |
| Remount agent, Madras | 700 | |
| Assistants, 1st class studs, Bengal | 400 | |
| „ 2nd class studs, Bengal | 300 | |
| Sub-assistants, 2nd class studs, Bengal | 200 | |
| Doing duty officers | 100 | With pay and allowances of rank. |
| CLOTHING DEPARTMENT. | | |
| Superintendent and agent for army clothing, Bengal | 1000 | With staff corps pay of rank. |
| „ „ „ Madras | 700 | |
| „ „ „ Bombay | 700 | |

TABLE OF SALARIES ALLOWED FOR STAFF OFFICERS AND DEPARTMENTS OF THE SEVERAL PRESIDENCIES IN INDIA—*continued.*

| | R | |
|---|---|---|
| PERSONAL STAFF. | | |
| Military secretary and aide-de-camp to the governor-general | 1500 | Consolidated. |
| „ „ to the governor, Madras | 1000 | |
| » » „ Bombay | 1000 | |
| Military secretary to the commander-in-chief in India | 1500 | |
| » » Madras | 1000 | |
| » » Bombay | 1000 | |
| Aides-de-camp to the governor-general, each | 300 | With staff corps pay of rank. |
| „ to the governor, Madras | 300 | |
| » „ Bombay | 300 | |
| Aides-de-camp to the commander-in-chief in India, each | 250 | |
| » » Madras, each | 250 | |
| » » Bombay, each | 250 | |
| Interpreter to the commander-in-chief in India | 450 | |
| » » Madras and Bombay | 350 | |
| Private secretary and aide-de-camp to a lieutenant-governor | 350 | |
| Aide-de-camp to lieutenant-governor | 250 | |
| „ to general officers commanding divisions | 250 | |
| MISCELLANEOUS. | | |
| Military secretary to government, Punjab | 700 | With staff corps pay of rank. |
| Staff officer, Punjab Frontier Force | 500 | |
| Military storekeeper, Bengal | 400 | |
| Secretary and examiner in Hindustani in Madras | 400 | |
| Commandant convalescent depots, 1st class* | 200 | With regimental or staff corps pay of rank. |
| » » „ 2nd Class* | 100 | |
| Station staff officers, 1st class (including all office charges) | 150 | With staff corps pay and allowances of rank. |
| » » » 2nd class (including all office charges) | 100 | |
| » » » 3rd class (including all office charges) | 50 | |
| » » » at very small stations | 25 | |
| NATIVE CAVALRY REGIMENTS, ALL PRESIDENCIES. | | |
| Commandant | 700 | With staff corps pay of rank. |
| 2nd in command and squadron officer | 300 | |
| 2nd squadron officer | 210 | |
| 3rd » » | 180 | |
| adjutant | 250 | |
| 1st squadron subaltern | 150 | |
| 2nd » » | 150 | |
| NATIVE INFANTRY REGIMENTS, ALL PRESIDENCIES. | | |
| Commandant | 600 | With staff corps pay of rank. |
| 2nd in command and wing officer | 270 | |
| Wing officer | 230 | |
| Adjutant | 200 | |
| Quartermaster | 150 | |
| 1st wing subaltern | 100 | |
| 2nd » » | 100 | |

* These appointments are usually held by British officers.

## III.—ENGLISH FURLOUGH PAY.

### STAFF CORPS.

| | £ | s. | d. |
|---|---|---|---|
| General officers | 1 | 5 | 0 |
| Brevet-colonel and lieutenant-colonel | 1 | 0 | 0 |
| Major | 0 | 16 | 0 |
| Captain | 0 | 10 | 6 |
| Lieutenant | 0 | 6 | 6 |

| INDIAN ARMY. | | Cavalry. | | | Infantry. | | | Artillery and Engineers. | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | £ | s. | d. | £ | s. | d. | £ | s. | d. |
| General | Not being regimental colonels, or in receipt of colonel's allowance | 1 | 18 | 0 | 1 | 18 | 0 | 1 | 18 | 0 |
| Lieutenant-general | | 1 | 12 | 6 | 1 | 12 | 6 | 1 | 12 | 6 |
| Major-general | | 1 | 5 | 0 | 1 | 3 | 0 | 1 | 3 | 0 |
| General officers, being regimental colonels, Colonels, regimental | In addition to colonel's allowance, if entitled thereto | 1 | 12 | 8 | 1 | 5 | 0 | 1 | 5 | 0 |
| Lieutenant-colonel | | 1 | 3 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| Major | | 0 | 19 | 3 | 0 | 16 | 0 | *0<br>†0 | 15<br>14 | 0<br>6 |
| Captain | | 0 | 14 | 7 | 0 | 10 | 6 | *0<br>†0 | 11<br>10 | 1<br>0 |
| Lieutenant | | 0 | 9 | 0 | 0 | 6 | 6 | 0 | 6 | 10 |
| „ on second lieutenant's pay | | | — | | | — | | 0 | 5 | 7 |
| Cornet or ensign | | 0 | 8 | 0 | 0 | 5 | 3 | | — | |

Colonel's allowance when issued with staff corps pay out of India or English furlough pay—all branches .. .. .. .. .. Per annum, £668 12 5

* Engineers. † Artillery.

### BRITISH MEDICAL SERVICE.—ENGLISH FURLOUGH PAY.

| | Daily. | | | | Daily. | | |
|---|---|---|---|---|---|---|---|
| | £ | s. | d. | | £ | s. | d. |
| Surgeon-general | 2 | 0 | 0 | Surgeon-major | 0 | 17 | 6 |
| After 25 years' service | 2 | 5 | 0 | After 15 years' service | 1 | 0 | 0 |
| „ 30 „ | 2 | 7 | 0 | „ 20 „ | 1 | 4 | 0 |
| „ 35 „ | 2 | 10 | 0 | „ 25 „ | 1 | 7 | 0 |
| Deputy surgeon-general | 1 | 10 | 0 | Surgeon, on appointment | 0 | 10 | 6 |
| After 25 years' service | 1 | 12 | 0 | After 5 years' service | 0 | 12 | 6 |
| „ 30 „ | 1 | 15 | 0 | „ 10 „ | 0 | 15 | 0 |
| „ 35 „ | 1 | 17 | 0 | „ 15 „ | 0 | 17 | 6 |

### INDIAN MEDICAL OFFICERS.—ENGLISH FURLOUGH PAY.

| RANK. | After 30 Years' Service on Full Pay. | | After 25 Years' Service on Full Pay. | | After 20 Years' Service on Full Pay. | | After 15 Years' Service on Full Pay. | | After 12 Years' Service on Full Pay. | | After 10 Years' Service on Full Pay. | | After 5 Years' Service on Full Pay. | | Under 5 Years' Service on Full Pay. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | £ | s. | £ | s. | £ | s. | s. | d. | s. | d. | s. | d. | s. | d. | s. | d. |
| Surgeon-general | 2 | 5 | 2 | 5 | 2 | 0* | — | | — | | — | | — | | — | |
| Deputy surgeon-general | 1 | 14 | 1 | 10 | 1 | 8* | — | | — | | — | | — | | — | |
| Surgeon-major | — | | 1 | 5 | 1 | 2 | 18 | 0 | 15 | 0* | — | | — | | — | |
| Surgeon | — | | — | | — | | — | | — | | 13 | 0 | 11 | 6 | 10 | 0 |

* Or on promotion should these periods of service not be already completed.

## VETERINARY SURGEONS.—ENGLISH FURLOUGH PAY.

| Rank. | After 25 Years' Service on Full Pay. | | After 20 Years' Service on Full Pay. | | After 15 Years' Service on Full Pay. | | After 10 Years' Service on Full Pay. | | After 5 Years' Service on Full Pay. | | Under 5 Years' Service on Full Pay. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | s. | d. | s. | d. | s. | d. | s. | d. | s. | d. | s. | d. |
| Staff veterinary surgeons .. .. .. .. | 23 | 0 | 22 | 0 | 21 | 0 | — | | — | | — | |
| Veterinary surgeons, 1st class .. .. .. .. | 20 | 0 | 17 | 0 | 15 | 6 | 14 | 6 | 12 | 9 | — | |
| Veterinary surgeons .. .. .. .. .. | 14 | 0 | 14 | 0 | 14 | 0 | 13 | 0 | 11 | 6 | 10 | 0 |

## IV.—PAY OF LIEUTENANTS AND SUB-LIEUTENANTS OF THE BRITISH ARMY.

| Rank. | Regimental Pay and Allowances for any Month. | | | | |
|---|---|---|---|---|---|
| | Royal Horse Artillery. | Field and Garrison Artillery. | British Cavalry. | British Infantry. | Royal Engineers. |
| | R. A. P. | R. A. P. | R. A. P. | R. A. P. | R. A. P. |
| Lieutenant .. .. .. | 250 10 4 | 213 5 0 | 250 10 4 | 202 12 5 | 213 5 0 |
| „ after 3 years' service in that rank .. | 305 4 0 | 265 12 0 | 305 4 0 | 256 10 0 | 265 12 0 |
| Sub-lieutenant .. .. .. | — | — | 250 10 4 | 202 12 5 | — |

In addition to the above rates of pay and allowances, horse allowance will be passed at 60 rupees per mensem in the horse artillery and cavalry, and at 30 rupees per mensem in field artillery batteries.

When, however, subalterns of the British army serving in India are not in receipt of any Indian allowances, they will be entitled to the following rates of pay, being the equivalent of the rates prescribed in the royal warrant dated 28th December 1871, converted into Indian currency at the exchange of two shillings halfpenny the rupee:—

| Rank. | Regimental Pay for any Month. | | | | |
|---|---|---|---|---|---|
| | Royal Horse Artillery. | Field and Garrison Artillery. | British Cavalry. | British Infantry. | Royal Engineers. |
| | R. A. P. | R. A. P. | R. A. P. | R. A. P. | R. A. P. |
| Lieutenant .. .. .. | 127 15 4 | 83 3 9 | 119 4 3 | 78 4 3 | 83 3 9 |
| „ after 3 years' service in that rank .. | 146 9 6 | 101 13 11 | 134 2 9 | 96 14 5 | 101 13 11 |
| „ after 10 years' service in that rank .. | 161 8 0 | 116 12 4 | 134 2 9 | 111 13 0 | 116 12 4 |
| Sub-lieutenant .. .. .. | — | — | 78 4 3 | 78 4 3 | — |

## V.—TABLE SHOWING THE PAY OF OFFICERS, NON-COMMISSIONED OFFICERS, AND MEN, IN THE BRITISH ARMY.

### STAFF.

| | | £ | s. | d. |
|---|---|---|---|---|
| General | Daily pay | 5 | 13 | 9 |
| Lieutenant-general | „ | 3 | 15 | 10 |
| Major-general | „ | 1 | 17 | 11 |
| Brigadier-general | „ | 1 | 18 | 6 |
| Colonel on the staff | „ | 1 | 2 | 9 |
| Adjutant- or quartermaster-general | „ | 1 | 17 | 11 |
| Deputy „ „ | „ | 0 | 19 | 0 |
| Assistant „ „ | „ | 0 | 14 | 3 |
| Deputy assistant adjutant- or quartermaster-general, brigade-major, assistant military secretary, or aide-de-camp | „ | 0 | 9 | 6 |

Head-quarters staff receive higher pay in addition to their pay or half-pay of their regimental commissions. Staff officers receive also allowances for horses.

### REGIMENTAL OFFICERS.

| RANK. | | Household Cavalry. | Foot Guards. | Infantry. | Cavalry. | Artillery. | Engineers. |
|---|---|---|---|---|---|---|---|
| General officer or colonel of a regiment, or colonel-commandant | Annual | £2800 | £2000 or £2200 | £1000 | £1350 | £994 | £990 |
| General officer not a colonel | „ | £450 | £450 | £450 | £450 | £450 | £450 |
| | | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Colonel | Daily | — | — | — | — | 1 6 0 | 1 6 0 |
| Lieutenant-colonel | „ | 1 9 2 | 1 6 9 | 0 17 0 | 1 3 0 | 0 17 11 | 0 17 11 |
| Major | „ | 1 4 5 | 1 3 0 | 0 16 0 | 0 19 3 | 0 16 0 | 0 16 0 |
| Captain | „ | 0 15 1 | 0 15 6 | 0 11 7 | 0 14 7 | 0 11 0 | 0 11 0 |
| Lieutenant | „ | 0 10 4 | 0 7 4 | 0 6 6 | 0 9 0 | 0 6 10 | 0 6 10 |
| Sub-lieutenant | „ | 0 8 0 | 0 5 6 | 0 5 3 | 0 8 0 | 0 5 7 | 0 5 7 |

### COMMISSARIAT AND TRANSPORT DEPARTMENT, AND ORDNANCE STORE DEPARTMENT.

| RANK. | On Appointment. | After 5 Years in the Rank. | Half-pay. | Retired Pay. After 30 Years' Service. | Retired Pay. After 20, but under 30 Years' Service. |
|---|---|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Commissary-general | 3 0 0 | 3 0 0 | 1 10 0 | 2 0 0 | 2 0 0 |
| Deputy-commissary general | 2 0 0 | 2 4 0 | 1 1 0 | 1 13 0 | 1 5 0 |
| Assistant commissary-general | 1 4 0 | 1 9 0 | 0 13 6 | 1 0 0 | 0 15 0 |
| Commissary | 0 18 6 | 1 2 0 | 0 10 0 | 0 16 8 | 0 14 0 |
| Deputy commissary | 0 11 6 | 0 14 0 | 0 7 0 | 0 11 8 | 0 9 6 |
| Assistant commissary | 0 9 0 | — | 0 4 6 | 0 7 8 | 0 6 0 |
| Sub-assistant commissary, pay sub-department | 0 6 6 | — | — | — | — |
| Paymaster | 1 0 0 | 1 2 6 | 0 12 6 | 1 0 0 | 0 5 0 |
| Deputy paymaster | 0 14 0 | 0 16 6 | 0 8 3 | 0 14 0 | 0 10 0 |
| Assistant paymaster | 0 10 6 | — | 0 5 3 | 0 9 0 | 0 7 6 |

### Quartermasters.

| Rank. | Guards. | Cavalry. | Infantry. | Horse Brigade and Riding Establishment | Field, Garrison, and Coast Brigade. | Engineers. |
|---|---|---|---|---|---|---|
| | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| Quartermaster on first appointment .. | 8 2 | 10 2 | 8 2 | 12 6 | 9 6 | 9 8 |
| After 10 years' service in the rank, or after 15 years' service as a commissioned or non-commissioned officer, including 5 years as quartermaster .. | 10 2 | 12 2 | 10 2 | 13 2 | 11 0 | 11 2 |
| After 15 years' service in the rank, or after 20 years' service as a commissioned or non-commissioned officer, including 10 years as quartermaster | 11 8 | 13 8 | 11 8 | 13 8 | 11 8 | 11 8 |
| After 32 years' service in the army, including 12 years as quartermaster | 13 2 | 15 2 | 13 2 | 15 2 | 13 2 | 13 2 |

### Medical Department.

| Rank. | On Appointment. | After 5 Years' Service. | After 10 Years' Service. | After 25 Years' Service. | After 30 Years' Service. | After 35 Years' Service. |
|---|---|---|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Surgeon-general .. .. .. | 2 0 0 | — | — | 2 5 0 | 2 7 0 | 2 10 0 |
| Deputy surgeon-general .. | 1 10 0 | — | — | 1 12 0 | 1 15 0 | 1 17 0 |
| Surgeon-major .. .. .. | 1 0 0 | 1 5 0 | — | — | — | — |
| Surgeon .. .. .. .. | £250 a year. | | 0 17 6 | — | — | — |

*Charge Pay.*—The principal medical officer of an army in the field consisting of 10,000 men and upwards, £1 daily; of 5000 and upwards, 15s. daily; of less than 5000, 10s. daily. The principal officer of a colony, where the number of commissioned officers and enlisted men is 1500 and upwards, 5s. daily.

### Veterinary Department.

| Rank. | On Appointment. | After 5 Years' on Full Pay. | After 10 Years' on Full Pay. | After 15 Years' on Full Pay. | After 20 Years' on Full Pay. | After 25 Years' on Full Pay. |
|---|---|---|---|---|---|---|
| | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. | £ s. d. |
| Principal veterinary surgeon .. | — | — | 1 0 0 | — | — | — |
| Staff veterinary surgeon .. .. | 1 1 0 | — | — | — | 1 2 0 | 1 3 0 |
| Veterinary surgeon, 1st class .. | 0 12 6 | — | 0 14 6 | 0 13 6 | 0 17 0 | 1 0 0 |
| *Veterinary* surgeon .. .. | 0 10 0 | 0 11 6 | 0 13 0 | 0 14 0 | 0 15 0 | 0 17 6 |

## EDUCATIONAL DEPARTMENT.

| | | |
|---|---|---|
| Inspector of army schools (in addition to 11s. 8d. per diem half pay), | Annual | £600. |
| Sub-inspector of army schools | Daily | 10s. |
| First-class schoolmaster | „ | 6s. 9d. |
| „ „ if re-enlisted | „ | 7s. 9d. |
| Second-class „ | „ | 5s. 3d. |
| „ „ if re-enlisted | „ | 6s. 3d. |
| Trained schoolmaster, on appointment* | „ | 3s. 11d. |
| Increased by 6d. a day for every 3 years' service as schoolmaster until it shall reach a maximum of | „ | 6s. 11d. |
| First-class schoolmistress | Annual | £44. |
| Second-class „ | „ | £36. |
| Third-class „ | „ | £30. |

* Rates increased by an addition of 2d. a day after 2 years' service in that rank.

## PAYMASTER DEPARTMENT.

| RANK. | If not holding the Rank of Captain when appointed | | | If holding the Rank of Captain when appointed. | | |
|---|---|---|---|---|---|---|
| | £ | s. | d. | £ | s. | d. |
| On first appointment | 0 | 12 | 6 | 0 | 15 | 0 |
| After 5 years' service as paymaster | 0 | 15 | 0 | 0 | 17 | 6 |
| After 15 years' service as commissioned or non-commissioned officer, of which at least 10 years shall have been as commissioned officer on full pay | 0 | 15 | 0 | | — | |
| After 10 years' service as paymaster | 0 | 17 | 6 | 1 | 0 | 0 |
| After 20 years' service as commissioned officer, of which at least 10 years shall have been as a commissioned officer on full pay, including not less than 5 years as paymaster in receipt of 15s. | 0 | 17 | 6 | | — | |
| After 15 years' service as paymaster | 1 | 0 | 0 | 1 | 2 | 6 |
| After 20 years' service as a commissioned officer on full pay, including not less than 10 years as paymaster | 1 | 0 | 0 | | — | |
| After 25 years' service as a commissioned and non-commissioned officer, of which at least 15 years shall have been as a commissioned officer on full pay, including not less than 10 years as paymaster | 1 | 0 | 0 | | — | |
| After 20 years' service as paymaster | 1 | 2 | 6 | 1 | 5 | 0 |
| After 25 years' service as a commissioned officer on full pay, including not less than 15 years as paymaster | 1 | 2 | 6 | | — | |
| After 30 years' service as commissioned or non-commissioned officer, of which at least 20 years shall have been as a commissioned officer on full pay, including not less than 15 years as paymaster | 1 | 2 | 6 | | — | |

## CHAPLAIN'S DEPARTMENT.

| | | £ | s. | d. | | £ | s. | d. |
|---|---|---|---|---|---|---|---|---|
| Chaplain-general | Annual | 1000 | 0 | 0 | | | | |
| Chaplains of 1st class | Daily | 1 | 0 | 0 | Rising to | 1 | 2 | 6 |
| „ 2nd class | „ | 0 | 17 | 6 | „ | | — | |
| „ 3rd class | „ | 0 | 15 | 0 | „ | | — | |
| „ 4th class | „ | 0 | 10 | 0 | „ | 0 | 12 | 6 |

## NON-COMMISSIONED OFFICERS AND MEN.

| RANK. | Guards. | | Line. | | Artillery. | | Engineers. | | Army Service Corps. | Army Hospital Corps. |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cavalry. | Foot. | Cavalry. | Infantry. | Horse and Riding Establishment. | Field, Garrison, and Coast. | Sappers and Miners. | Train. | | |
| | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. | s. d. |
| Sergeant or corporal-major, regimental | 4 10 | 3 9 | 4 1 | 3 9 | 4 10 | 4 8 | 5 1½ | 5 5 | 5 6 | 4 10 |
| * ,, ,, troop | 4 0 | — | 3 3 | — | — | — | — | 4 0 | — | — |
| *Bandmaster | 4 6 | 3 5 | 3 9 | 3 3 | 6/1 | | 6/1 | | — | — |
| *Quartermaster-sergeant or corporal-major | 4 0 | 2 11 | 3 3 | 2 9 | 4 0 | 3 10 | 4 3½ | 5 1 | {from 4/1 to 4/7} | — |
| *Sergeant instructor of musketry or gunnery, or sergeant or corporal instructor of fencing and gymnastics | 3 4 | 3 1 | 3 1 | 3 1 | 4 0 | 3 10 | — | — | — | — |
| *Battery sergeant-major or quartermaster | — | — | — | — | 4 0 | 3/10 and 3/5 | — | — | — | — |
| Master gunners; 1st, 2nd, and 3rd class | — | — | — | — | 5/4, 3/10 and 3/4 | | — | — | — | — |
| *Colour sergeant | — | 2 9 | — | 2 7 | — | — | — | — | — | 3 6 |
| *Paymaster, or orderly room clerk or sergeant | 2 11½ | 2 3 | 2 5 | 2 1 | 3 1 | 2 11‡ | — | — | — | — |
| After 3 years' uninterrupted service in the rank | 3 5½ | 2 9 | 2 11 | 2 7 | 3 7 | 3 5 | — | — | — | — |
| After 5 years' uninterrupted service in the rank | 3 7½ | 2 11 | 3 1 | 2 9 | 3 9 | 3 7 | — | — | — | — |
| Trumpet, drum, pipe, or bugle-major | 3 2 | 2 3 | 2 5 | 2 1 | 3 1 | 3/10 and 2/11 | 4 3½ | — | — | — |
| *Sergeant | — | 2 3 | 2 5 | 2 1 | 3 1 | 2 11 | 2 11½ | 3 3 | 2 5 | 2 6 |
| Lance sergeant | — | 2 1 | 2 3 | 1 11 | — | — | — | — | 2 3 | 2 4 |
| †Corporal | 2 11½ | 1 5 | 1 7½ | 1 4 | 2 4 | 2 2 | 2 2½ | 2 6 | 1 7½ | 1 9 |
| Lance corporal | 2 9½ | 1 4 | 1 6½ | 1 3 | — | — | 1 10 | 2 1 | 1 5 | 1 5 |
| †Bombardier, or 2nd corporal | — | — | — | — | 2 2 | 2 0 | 1 11 | 2 2 | 1 6 | 1 6 |
| Acting bombardier | — | — | — | — | 2 1 | 1 11 | — | — | — | — |
| Private, gunner, driver, or sapper | 2 0½ | 1 1 | 1 2 | 1 0 | 1/4 and 1/3 | 1 2½ | 1 1½ | 1 4 | 1 2 | 1 2 |
| Boys, until they attain the age of 15 years | 1 0 | 0 7 | 0 7 | 0 7 | 0 9 | 0 9 | 0 9 | — | — | — |
| Kettle-drummer | 2 7 | — | 1 9 | — | — | — | — | — | — | — |
| Trumpeter, bugler, piper, fifer, or drummer | 2 2 | 1 1 | 1 4 | 1 1 | 2 0 | 1 2½ | 1 1½ | 1 4 | 1 2 | — |
| *Farrier and carriage smith-major | 4 3 | — | 3 9 | — | 4 2§ | 4 0§ | — | 4 3 | — | — |
| *Collar-maker and wheeler-major or corporal | — | — | — | — | 3 8§ | 3 6§ | — | 2 8 | — | — |
| *Armourer sergeant or corporal, or battery armourer sergeant | 5 4 | 5 1 | 5 1 | 5 1 | 3 1 | 2 11‖ | 2 11½ | — | — | — |
| *Saddler sergeant or corporal | 2 11½ | — | 3 5 | — | — | — | — | — | — | — |
| *Farrier corporal, or farrier carriage smith | 3 5 | — | 2 7 | — | 3 6 | 3 4 | — | 3 5 | — | — |
| Saddler and saddle-tree maker | — | — | 1 9½ | — | — | — | — | — | — | — |
| Collar-maker and wheeler | — | — | — | — | 2 0 | 1 10 | — | 1 11 | — | — |
| Shoeing and carriage smith | 2 8 | — | 1 10 | — | 2 2 | 2 0 | — | 1 11 | — | — |

* Rates increased by an addition of 2d. a day, after 2 years' service in the rank of sergeant. † Increased by 1d. a day, after 2 years' service in their several ranks.

‡ Artillery paymaster, or orderly room sergeant, appointed to a field brigade prior to February 16, 1874, after 3 years' uninterrupted service in the rank, without further increase, 3s. 9d.

§ If appointed subsequent to August 16, 1866. ‖ Armourer sergeant in garrison brigades armed with interchangeable arms, 5s. 1d.

# APPENDIX P.

## I.—TABLE SHOWING THE POWER OF PENETRATION OF BOTH FIELD AND HEAVY ARTILLERY UP TO THE 7-INCH RIFLED GUN.

| | Nature of Gun. | Mean Penetration of Shell at 1060 yards. | | | Extreme Penetration of Shot or Shell. | Thickness of Parapet in Feet to be used for Cover. | Remarks. |
|---|---|---|---|---|---|---|---|
| | | Into a Natural Butt. | | Made Earth (Clay) well rammed. | | | |
| | | Natural Concrete. | Sand, Clay, &c. | | | | |
| | | ft. in. | ft. in. | ft. in. | ft. in. | ft. | |
| Newhaven experiments, 1863. | 7-in. B.L.R. gun | 7 9 | 12 11 | 18 3 | 21 11 | 25 to 30 | Corresponding gun at present is the 64-pr. |
| | 70-pr. " " | 6 4 | .. | 14 3 | 17 0 | 25 to 30 | |
| | 40-pr. " " | 6 1 | .. | 11 8 | 16 4 | 18 to 25 | |
| | 20-pr. " " | .. | 7 0 | 10 3 | 13 3 | 15 to 18 | |
| | 12-pr. " " | .. | 3 2 | 4 0 | .. | 6 to 9 | |
| | 10-in. S.B. gun | 3 10 | .. | 11 0 | 12 0 | 15 to 18 | |
| | 8-in. " " | 3 6 | .. | 11 5 | 12 9 | 15 to 18 | |
| | 68-pr. " " | 4 0 | 7 6 | 14 10 | 21 6 | 25 to 30 | |
| | 32-pr. " " | 2 8 | 5 8 | 9 5 | 14 0 | 18 to 25 | |
| | 24-pr. " "<br>18-pr. " " | From 12 to 15 feet into earth | | | | 18 to 25 | |
| | 12-pr. " " | From 8½ to 10 feet | | | | 12 to 15 | |
| | 9-pr. " " | From 6½ to 7 feet | | | | 9 to 12 | |
| | 6-pr. " " | From 3½ to 4 feet | | | | 6 to 9 | |

| Nature of M.L.R. Gun. | 12-in. | 10-in. | 9-in. | 8-in. | 7-in. |
|---|---|---|---|---|---|
| | ft. | ft. | ft. | ft. | ft. |
| Maximum penetration { Brickwork .. .. .. .. .. | 15 | 14 | 12 | 11 | 7 |
| Maximum penetration { Rubble masonry .. .. .. .. | 10 | 9 | 8 | 7 | 5 |
| | in. | in. | in. | in. | in. |
| Thickness of single plate of iron, just able to keep out the projectile .. .. .. .. .. .. .. .. .. | 15 | 14 | 11 | 10 | 5 |

---

## II.—TABLE SHOWING THE POWER OF PENETRATION OF THE SNIDER-ENFIELD AND MARTINI-HENRY RIFLES.

| | | |
|---|---|---|
| **Snider-Enfield** .. .. | 19 inches of light and sandy earth<br>3 " solid oak<br>6 " elm<br>12 " fir | at 20 yards. |
| | Wrought-iron plate ·261 inch thick at 100 yards. | |
| **Martini-Henry** .. .. | 4½ inches of oak at 50 yards. | |
| | 12 " fir at 100 " | |
| | 3 " fir balks dry and 1 wet at 100 yards. | |
| | 4 thicknesses of 3-inch rope at | 350 " |
| | A gabion filled with clay-earth at | 25 " |
| | A sap-roller at | 25 " |
| | A sandbag at | 100 " |
| | Wrought-iron plate ·261 inch thick at | 200 " |
| | " " ·312 " | 25 " |
| | Earthen parapet 21 inches thick at | 10 " |

LONDON:
PRINTED BY WILLIAM CLOWES AND SONS,
STAMFORD STREET AND CHARING CROSS.

# SUPPLEMENT

TO THE

# MILITARY DICTIONARY.

## GIVING CERTAIN ADDITIONS AND CORRECTIONS FROM 1877 UP TO THE END OF 1881.

A.C. means Army Circular.
R.W. means Royal Warrant.

## A.

**Academy, Royal Military, Woolwich**—Appendix A, par. 5: For December 1 read "October 15." and for July 1 read "May 15." Sect. 2, par. 49, should read as follows:—"The rates of pay (and allowances) laid down for all officers appointed to our Royal Military Academy subsequent to the 7th May, 1874, shall include all remuneration of every kind except any additional pay to which an officer may be entitled as a reward for distinguished service in the field, and no person so appointed shall be entitled to pension or superannuation allowances for services in such appointment."

**Acquittance Roll** — The document bearing this name has been discontinued for some time past in the army, and another form of certificate has been adopted for obtaining the soldier's acknowledgment of his pay, &c.

**Active List**—Means officers on full or half-pay, liable for active service. Permanent half-pay is no longer permitted.

**Adjutant**—The office to be held by a Captain or Junior Major of a territorial regiment for a term of five years under the circumstances mentioned in the Revised Army Regulations of 1881, Vol. 1.

**Aide-de-Camp**—If not passed the Staff College, must have passed the examination for promotion to the rank of Captain, and will further be required to pass an examination in foreign languages. *Vide* Queen's Regulations.

**Air-space**—In the formation of cartridges for heavy guns, the term air-space is applied to the space given between the outer and inner cloth of the cartridge; by which arrangement the pressure on the powder-chamber is greatly relieved. The same term is also applied to the outer and inner skin of an iron-plated target or vessel.

**Alarm Post**—Insert in page 8 of the Dictionary, line 13 from top of right-hand column, after word "off," "in some central position."

**Ambulance** — *Vide* Dictionary. In most of the large towns in England, as well as in other needed localities, such as dockyards and arsenals, an ambulance society has been formed to give assistance to people who have met with accidents and who are unable in consequence to help themselves.

**Appointments, First, to the Army,** *vide* Royal Warrant relating to Pay and Promotion, Part 1 (Army Regulations, Vol. 1).

**Army Hospital Corps** — The regulations for this corps will be found in A.C. February 1878.

**Armour Plating**—Considerably increased in thickness since the article in the Dictionary on this subject was written. In some of the ships of the British Navy a thickness of from 18 to 24 inches is given. One or more iron-clads in the Italian Navy have 27½ inches.

**Army Reserve**—Page 19 of Dictionary, 10th line from top of page, right-hand column, for "six" read "seven." As stated in the Revised Army Regulations, 1881, a portion of the soldiers on home service, after completing three years' colour service, will be allowed and encouraged to pass into the Reserve for nine years' Reserve service ; on or before completing this service, power will be taken to enable men of the Army Reserve to enter voluntarily on a further period of four years in the Reserve. They will form a second Reserve. The number of men from time to time which shall form the 1st class of the Army Reserve will depend upon the provision made by Parliament.

**Army Service Corps**—A change has taken place in the designation of this corps since the Dictionary was published. The companies of the corps employed on commissariat or transport duties are now styled "The Commissariat and Transport Corps," and those engaged on ordnance duties "The Ordnance Store Corps."

**Army Signalling**—There are two schools for teaching this important subject, at Aldershot and Chatham. The Inspector resides at the latter place, and after his inspections reports to the general officer commanding.

**Artillery, Royal**—Consists of 214 Batteries, Horse, Field, and Garrison, which includes the depot batteries. The number of guns composing a horse or field battery consists of 6 guns.

The reorganisation of this regiment as at present constituted took place in 1877. The regiment consists now of 3 brigades of horse artillery, designated A, B, and C respectively. Each brigade has its head-quarters and 6 batteries at home, and the remaining 5 batteries of each brigade in India. The present depot batteries, numbering 422 men of all ranks, are divided and attached to the head-quarters of the brigades at home, making the strength of each about 970 of all ranks, instead of 830 as hitherto. The batteries of each brigade serving in India amount to about 821 of all ranks, showing a very slight reduction—altogether in the brigade staff—upon the present establishment, and making the total strength of the royal horse artillery in India 2482.

The field and garrison batteries consist now of 11 brigades, of which 6—the 1st to the 6th—are field, and the remaining 5—the 7th to the 11th—garrison artillery. The head-quarters of each brigade always remains in the United Kingdom, and the existing depot brigade, numbering 1946 of all ranks, is distributed between the home or head-quarters division of the newly-formed brigades. As regards each of the field brigades, 8 batteries, 7 service and 1 depot remain at home, the aggregate strength being 1306, while 7 batteries remain in India, at an aggregate strength of 1145, except in the case of the new 3rd brigade, which has 8 batteries at a strength of 1308 on the Indian establishment. The strength of the field artillery in India has been reduced by 11 batteries. The reduction of the total strength of the field and garrison artillery in India only affects the brigade staff.

Respecting the 5 newly-formed brigades of garrison artillery, the head-quarters and home establishment of each are alike, consisting of 7 service batteries, of a strength of 994, and a depot battery of 229, making the total numbers at home 1223. But the arrangement for the foreign establishment varies somewhat in each case.

Since the insertion of the foregoing a new organisation has taken place, which consolidates in two brigades the existing three brigades of Royal Horse Artillery, condenses the six brigades of field artillery into four, and makes the present five garrison brigades into one comprehensive brigade with 11 divisions. To effect these changes the following redistribution of the batteries has taken place:—

### ROYAL HORSE ARTILLERY.

A Brigade of 13 batteries (A to N), made up of the existing A Brigade, and F, A, G, and E Batteries of C Brigade.

B Brigade of 13 batteries (A to N), made up of existing B Brigade and the remaining batteries of C Brigade.

Depot Batteries.—A to be retained ; B to be reduced ; C to become B.

### FIELD ARTILLERY.

1st Brigade of 24 batteries (A to X), made up of the present 1st Brigade, and parts of the 3rd, 5th, and 6th Brigades.

2nd Brigade of 19 batteries (A to S), of present 2nd Brigade (less one battery), and parts of 3rd, 5th, and 6th Brigades.

3rd Brigade of 18 batteries (A to R), of parts of 3rd, 4th, and 5th Brigades.

4th Brigade of 18 batteries (A to R), of 10 batteries of present 4th Brigade, one of 2nd, two of 3rd, four of 5th, and one of 6th Brigades.

### GARRISON ARTILLERY BRIGADE.

Northern Division.—Nine batteries and depot, made up of parts of 2nd, 7th, 8th, and 9th Brigades.

Lancashire Division.—Eight batteries and depot, made up of 5th, 7th, 9th, 10th, and 11th Brigades.

Eastern Division.—Nine batteries and depot, parts of 6th, 7th, 8th, 9th, and 11th Brigades.

Cinque Ports Division.—Nine batteries and depot, parts of 7th, 8th, 9th, 10th, and 11th Brigades.

London Division.—Eight batteries and depot, parts of 1st, 8th, 9th, 10th, and 11th Brigades.

Southern Division.—Nine batteries and depot, parts of 7th, 8th, 10th, and 11th Brigades.

Western Division.—Nine batteries and depot, parts of 7th, 8th, 9th, and 10th Brigades.

Scottish Division.—Nine batteries and depot, parts of 4th, 7th, 9th, 10th, and 11th Brigades.

Welsh Division.—Eight batteries and depot, parts of 8th, 9th, 10th, and 11th Brigades.

North Irish Division.—Nine batteries and depot, parts of 3rd, 7th, 8th, 9th, 10th and 11th Brigades.

South Irish Division.—Nine batteries and depot, parts of 8th, 9th, 10th, and 11th Brigades.

The depots allotted to each territorial division of artillery are to receive all artillery recruits, except those enlisted at the head-quarters of a battery belonging to the district, clothe and instruct them in preliminary drills, after which they will be posted under orders from the adjutant-general to service batteries at home for further instruction. No recruit is to be retained in the depot, under any pretence whatever, longer than is necessary for his preliminary drills. On leaving the depots for the service batteries, the recruits will be instructed in the more advanced drills and exercises, mounted and dismounted, and the men will be posted to batteries in such numbers as to admit of squads being formed for this purpose. All batteries of horse and field artillery not belonging to the first army corps, and all batteries of garrison artillery at home are to train recruits and supply drafts for the batteries of their respective branches and divisions serving abroad.

In the above reorganisation it is ordered that brigade commands are to be abolished, and the staff of existing brigades converted into district staff. The order further states that the only office to be maintained will be the district officer, under the charge of the brigade major or the adjutant of the district. A number of lieutenant-colonels in the army districts at home and in the colonies will exercise the power of commanding officers. These lieutenant-colonels will each be assisted by an acting adjutant and a permanent clerk. In the horse and field artillery the acting adjutants will be borne on the establishment of a battery serving in the district; in the garrison artillery they will be in excess of the battery establishments. Their nominations will rest with the lieutenant-colonels commanding, but are to be submitted to head-quarters for approval. Lieutenant-colonels in excess of the commands will be attached to a regimental division or district. The duties of colonels on the staff and other officers commanding districts have already been laid down. The lieutenant-colonel for auxiliary artillery in the several districts, with the exception of Woolwich, will, in addition to his present duties, be charged with the command of the artillery depot of the territorial division in which he is serving, and will exercise all the powers of a commanding officer. He will conduct the whole of the recruiting duties for the Royal Artillery in the area allotted to him, and will have the assistance of the adjutant and permanent staff of the militia artillery brigade at the headquarters of his division. Quartermasters not attached to artillery depots are to be employed with the barrack and conservancy duties of the stations to which they are appointed, and upon any other duties of their department that the officer commanding may direct. The promotion of non-commissioned officers up to and inclusive of the rank of sergeant will be carried out in each battery, but to battery staff-sergeants throughout the same brigade serving in a district, and to the higher grades by selection, to be made at the office of his Royal Highness.

The above organisation takes place from the 1st April, 1882.

## B.

**Balloon Captive.**—This balloon is described in the body of the Dictionary. It is likely to be used in all future military expeditions, a method of producing hydrogen gas by means of iron filings immersed in diluted sulphuric acid having been tried successfully at Woolwich, rendering the manufacture of gas in the field no longer an impossible operation.

**Band**—Officers below the rank of Captain in the Army, except in the Royal Artillery and Royal Engineers, will not be required to subscribe to the regimental Band. *Vide* Queen's Regulations, 1881.

**Bank of a River**—The high or low ground on either side of the channel or bed in which the water of a river flows. It is designated the *right* or *left* bank, the former being on the right hand away from its source, looking towards the mouth of the river, the latter on the left hand.

**Barrel, Gun** — The barrel of the *Martini-Henry* rifle is made of steel.

**Base of Operations,** *vide* A.C. June *1878,* in which the regulations to be observed by an army in the field for keeping up its communications will be found.

**Battery, Voltaic**—The battery commonly used for telegraph equipment is Le Clanché's 10-cell.

**Bayonet**—The Martini-Henry blade is 22½-inch long; it is equilateral, and has no outward cant when fixed on the rifle. Weight of bayonet, with locking ring and screw complete, 24 oz.

The dimensions of the saw-backed sword-bayonet are as follows:—

| | | |
|---|---|---|
| Length of bayonet | ... | 24⅝ inches. |
| „ blade | ... | 20¼ „ |
| Width of blade... | ... | 1 inch. |
| Weight of bayonet | ... | 1 lb. 9½ oz. |
| Weight of scabbard, with springs | ... | 7½ oz. |

**Billet**—Under this head in the body of the Dictionary, page 40, line 13 from top of page, left-hand column, for "10*d.*" read "1*s.* 1½*d.*," and insert, "Where no hot meal is furnished, payment will be 4d. per diem." An officer pays 2*s.* per night for his lodging, and finds himself in food. For offences in relation to billeting, *vide* Army Act, 1881, Part 1.

**Bivouac**—Under this head in the Dictionary the advantages of bivouacs are given, but the disadvantages are not shown. General Lewal of the French Army, in his work 'La Tactique de Stationnement' says—"As regards bivouacs, their advantages are well known, while they present more serious inconveniences than are generally admitted. Men and horses sleep but little, and are unable to repose themselves properly; they feed badly and contract disease." Notwithstanding what General Lewal points out, circumstances will occur at times on service which necessitate the bivouacking of an army or force of any kind.

**Blocks**—Made of wood, and also of malleable iron, for military purposes. They are used of the latter material for the loading tackle of heavy rifled guns.

**Bothway Blocks**—18-inch, 15-inch, 12-inch, 10-inch, 9-inch, and 8-inch, are found in use in the artillery service.

**Bore**—To facilitate loading, the muzzle of all rifled ordnance of 10-inch calibre and upwards is slightly enlarged.

**Bounty**—When recruiting given only to the bringing or recruiting party at rates stated in the new warrant, dated 1st July, 1881.

**Brigade Depot**—As shown in A.C. May 1, 1877, the command of a brigade depot, in the absence of the commanding officer, will revert to the general officer commanding, upon whom will devolve the responsibility of the general duties of the sub-district. The regimental duties of the depot will be carried on by the senior officer present; but all correspondence on general subjects will be noted and passed on by him to the general officer commanding the district for disposal.

**Brigade Major**—Consequent on the reorganisation of the Royal Artillery, brigade-majors of artillery have been added to staff-establishments as follows: viz., to the northern district, south-eastern district, southern district, western district, Dublin district, Cork district, Gibraltar, and Malta. An officer under the rank of Captain is not eligible to hold the post of Brigade-Major in the army.

**Brigadier General**—The rank is local or temporary only.

**British Army**—Para 5 under this head in the Dictionary has been modified, and all regiments are now linked. Expunge 8th para, giving the strength of the artillery in 1876. 10th para of this article has been modified, the numbers fluctuating from year to year.

**Busby**—Superseded by the helmet.

## C.

**Cadets**, *vide* royal warrant, dated May 1, 1877, for the rules appertaining to Queen's cadets and honorary Queen's cadets; also clause 90, A.C. of May 1, 1878, and Revised Army Regulations, vol. i., 1881.

**Carbines**—The Martini-Henry carbine has been issued to all troops of the regular service, who by the regulations are armed with this nature of weapon.

**Carriage, Moncrieff**—A carriage of this nature has been adopted for the 9-inch rifled gun of 9 tons. It differs somewhat from the carriage approved of for the 7-inch gun.

**Carrier-Pigeon**—Considerable information is given in the body of the Dictionary on the subject of Carrier-Pigeons; but the following will, doubtless, be considered interesting, taken from the *Broad Arrow*. "How to transmit information from without to within a beleaguered fortress is a problem, the satisfactory solution of which has yet to be worked out. During the investment of Paris by the Germans in 1870–71, the pigeon-post, as is well known, was found to be the best means available, and during the latter part of the siege these aërial messengers were largely employed. The despatches to be carried by them were reduced by photography to the smallest possible dimensions, fastened under the wings of the pigeons and conveyed by them over the investing lines into the capital, where they were again enlarged and transcribed. The success which attended these proceedings has naturally caused attention to be turned to the possibility of employing this means of communication on a more extended scale in future wars. In the French Estimates for next year a considerable sum is provided for the purpose of breeding pigeons for military purposes, and in Germany also the breeding of carrier-pigeons has been largely developed. A Baden paper gives some interesting details of trials which have been recently made at Strasburg. A hundred and thirty pigeons taken from this latter town were liberated at Heidelberg, and the swiftest of the birds reached Strasburg again in one hour and a quarter; having flown during that time nearly eighty miles. Another covey was set loose at Adelsheim, and reached Strasburg in two hours, having traversed rather more than a hundred miles. A third batch of 128 birds, set free at Carlsruhe, arrived in Strasburg in a few minutes over the hour—the distance between the two places being about fifty miles. Only a very few of the birds failed to return to their home, the total loss during the trials we have described amounting to less than two per cent. of the pigeons employed."

**Cartridges, Gun**—Cartridges made of silk cloth have superseded serge cloth, except for the 7-pr. rifled M.L. gun.

**Castrametation,** *vide* Revised Regulations for encampments, 1877.

**Casual**—A term used in musketry instruction, and applied to a soldier who, for some reason or another, is unable to finish the musketry course with his own company.

**Chaco**—Superseded in the British army by the helmet.

**Chamber of a Gun**—Enlarging the powder-chamber of a rifled gun has been attended with great advantage, adding to the initial velocity and range of the gun, by admitting of greater capacity for an increased charge of powder, and greater space for the development of the charge, thereby reducing the strain on the gun.

**Clarkson's Material**—This material is used for making cartridge cases for M. L. R. heavy guns; it consists of canvas on the inner side, a layer of cork glued over it by india-rubber cement, and then in the same manner the cork covered with canvas, and this again with leather. The india-rubber cement is made by dissolving india-rubber in naphtha in the proportion of 1 lb. of the former to 1 gallon of the latter; two coats are laid on between the services to be cemented. (*Treatise on Field Carriages by Captain W. Kemmis, R.A.*)

**Coast Brigade, Royal Artillery,** *vide* royal warrant of August 13, 1877, for the latest orders regulating the organisation of this branch of the service.

**College, Military, Kingston**—The following are the regulations under which the periodical examinations at the new Military College, Kingston, Canada, are held:—

The period of four years' instruction at the Military College will be divided into eight terms.

The terms will extend from about 3rd February to 20th June, and from about the 10th September to 2nd February.

There will be eight classes: cadets on joining at the Military College will be placed in the eighth class, and must rise into the third class in order to complete the several subjects of the obligatory or qualifying course.

Cadets who have passed out of the third class into second and first classes will devote their time to such voluntary subjects as they may select, in addition to any uncompleted obligatory subjects studied in the second and first classes.

To qualify for class promotion at the final examination, a cadet must obtain one-half the marks allotted to the obligatory sections of the course in the following subjects, viz.:—

Mathematics, fortification, artillery, military history and administration, military drawing and drills, and one-half of the total aggregate of the marks allotted to all the obligatory subjects.

No obligatory subject shall gain a cadet any marks unless he obtain half marks in that subject.

No section of a voluntary subject shall gain a cadet any marks unless he obtains one-third marks in that section.

No voluntary section of a subject of instruction shall be commenced by, or gain any marks for, a cadet until the obligatory sections of that subject have been completed.

A cadet, although he may have completed the obligatory and commenced the voluntary sections of any subject, will be examined with his class at the end of each term in the obligatory sections of that subject.

Examinations for class promotion will be held at the end of each term. Any cadet who fails to qualify at the end of the fourth, and has also failed at any previous term, or who fails at the end of both fifth and sixth terms, will be removed from the college. Such removal, or failure to qualify at the final examination, will render a cadet ineligible for a commission in the Militia, or to be qualified to profit by his having been admitted to the Military College for consideration for employment in the public service.

Quarterly examinations will also be held, the marks obtained at which will be amalgamated with those awarded at the half-yearly examinations.

The proportion of marks assigned to each of the quarterly examinations in any class will be about one-eighth of the total allotted for that class.

Marks will also be assigned for notes, recitations, and drawings executed by any class. Those for notes and recitations will be about one-eighth of the total allotted for that class. Each drawing will have a specific maximum value attached to it.

**College, Royal Military**—The following regulations respecting examinations for admission to the Royal Military College, and for first appointments therefrom to the army have been approved by the Field-Marshal commanding-in-chief.

## I. Object of the Royal Military College.

1. The Royal Military College is maintained for the purpose of affording a special military education to candidates for commissions in the cavalry and infantry.

2. Candidates for first appointments to the army will, with the exception of lieutenants of militia, and non-commissioned officers recommended for promotion, be required in future to pass through a course of instruction as cadets at the Royal Military College.

## II. Regulations for Admission.

### 1. *General Instructions.*

3. Admission to the Royal Military College as cadets will be granted—(*a*) To a successful candidate at a competitive examination in general subjects to be held under such regulations as may be issued from time to time. (*b*) To a graduate in arts at the universities of Oxford, Cambridge, Durham, London, Dublin, Edinburgh, St. Andrew's, Glasgow, Aberdeen, and the Queen's University, Ireland, or to a student who has passed Moderations at Oxford, the Previous Examination at Cambridge, the final examination of the senior freshman year at Dublin, the first year's examination at Durham, the first university examination in arts or in engineering at Queen's University, Ireland, the examination for candidates for the army at Scotch universities, and the first examination for the degrees of B.A., LL.B., B.Sc., or M.B., at London University; subject in each case to the competitive examination prescribed by par. 22. (*c*) To cadets styled Queen's cadets, honorary Queen's cadets. Indian cadets, and to pages of honour.

4. The number of cadets admitted to the college will vary, according to the requirements of the service.

5. The dates of admission will be the February 10 and September 1 in each year.

6. The examination of candidates for admission to the Royal Military College as cadets will be conducted by the Civil Service Commissioners, and will take place twice a year, in the months of December and July.

7. Notice will be given from time to time of the day and place of the examinations, and of the number of vacancies open to competition at each periodical examination.

8. The number of trials allowed will not exceed two in the case of university candidates, and three in that of other candidates.

9. All candidates will be inspected by a medical board; and no candidate will be considered eligible for a commission unless certified by the board to be free from any bodily defects or ailments, and in all respects, as to height and physical qualities, fit for her Majesty's service. Cases of exceptional shortness of stature will be referred to the War Office for special consideration.

10. The limits of age for candidates for admission to the Royal Military College by competition, for Queen's cadets, Queen's honorary cadets, Indian cadets, and pages of honour, will be from 17 to 20; for students of the universities who shall have passed the interim examination as specified in par. 3 (*b*), from 17 to 21; and for graduates of the universities who shall have passed the examination for the degree of B.A. or M.A., from 17 to 22.

11. Competitors who desire to obtain commissions in West Indian regiments may be admitted up to the age of 24.

This extension of the limit of age will not apply to university candidates.

12. Candidates must be within the prescribed limits of age on the following dates:—Candidates for admission by competition, Queen's cadets, Queen's honorary cadets, Indian cadets, and pages of honour, on January 1 next following the winter examination, and on July 1 for the midsummer examination. Graduates and students from the universities, as specified in par. 21.

### 2. *Examination of Candidates for Admission by Open Competition.*

13. A candidate for admission by competition at the December or July examination, must send to the Military Secretary, not later than October 15 or May 15, respectively, an application to be examined, accompanied by the following papers:—(*a*) An extract from the register of his birth; or, in default, a declaration made by one of his parents or guardians before a magistrate, giving his exact age. (*b*) A certificate of good moral character, signed by the tutors or heads of the schools or colleges at which he has received his education from his twelfth year to the date of application, or some other satisfactory proof of good moral character.

14. When a candidate who has once been examined applies to be examined again, he will only be required to forward a certificate as to his moral character for the interval between the two examinations.

15. A candidate will be required to satisfy the Civil Service Commissioners in the following subjects:—(1) Mathematics, viz. (*a*) arithmetic, including vulgar and decimal fractions, proportion, and simple interest; (*b*) geometry, not beyond the standard of the first book of Euclid. (2) French, German, or some other modern language; the examination being limited to a translation from the language, and grammatical questions. (3) Writing English correctly, and in a good legible hand, from dictation. (4) The elements of geometrical drawing; including the construction of scales, and the use of simple mathematical instruments. (5) Geography.

16. No marks will be allotted for the above preliminary examination, excepting for geometrical drawing, the maximum number for which will be 300. The preliminary examination will be dispensed with in the case of candidates who have passed it at previous examinations, but they may again take up geometrical drawing if they wish to obtain marks in that subject.

17. The "further examination" will be proceeded with immediately on the conclusion of the "preliminary examination." Candidates who fail in the preliminary examination will be informed of their failure as soon as possible, and they will then be released from further attendance.

18. The subjects of the further examination, and the maximum number of marks obtainable for each subject, will be as follows:—

| | Marks. |
|---|---|
| (1) Mathematics, viz. algebra, up to and including quadratic equations; the theory and use of logarithms, geometry, plane trigonometry, and mensuration. . . . . | 3000 |
| (2) English composition, tested by the power of writing an essay, letter, or précis; English literature, limited to specified authors; and English history, limited to certain fixed periods; the authors and periods being notified beforehand . . . | 3000 |
| (3) Latin . . . . . . . . | 3000 |
| (4) Greek. . . . . . . . | 2000 |
| (5) French, the examination to be partly colloquial . . . | 2000 |
| (6) German, the examination to be partly colloquial . . | 2000 |
| *(7) Experimental sciences, viz.—(*a*) chemistry and heat, or (*b*) electricity and magnetism . . . . . . . | 2000 |
| (8) General and physical geography, and geology . . | 2000 |
| (9) Drawing, free-hand . . . | 1000 |

Of these nine subjects, candidates will not be allowed to take up more than four nor less than two, exclusive of drawing.

19. In order to secure a proper pro-

---

* Subjects (*a*) and (*b*) are alternative; a candidate will not be allowed to take up both.

ficiency in all the subjects taken up by a candidate, a certain number will be deducted from the marks gained by the candidate in each subject.

20. The following will be the mode of selecting the successful candidates at the open competitive examination. After the proper deduction (in accordance with par. 19) has been made from the number of marks gained by each candidate in the several subjects in which he has been examined, the remainders will be summed up, and the marks gained by the candidate, in geometrical drawing, at the preliminary examination will be added thereto. The resulting total will determine the place of the candidate in the competitive list; the successful candidates being those who stand at the head of the list up to the number of cadetships competed for.

### 3. *Examination of University Candidates.*

21. A graduate or student of one of the universities specified in par. 3, who, having obtained his university qualification while within the maximum limit of age specified in par. 10, is desirous of becoming a candidate for a cadetship at the Royal Military College, must send an application to the Military Secretary in the month of May or October, with a view to his appointment under the provisions of par. 22; but no such application can be admitted before the candidate has actually attained the age of seventeen, nor later than May 31 or October 31 next following the date of his attaining the maximum limit of age prescribed for graduates and students, respectively, in par. 10. The application must be accompanied by papers (*a*) and (*b*) described in par. 13, and by a certificate from the proper authority that he has taken his degree in arts, or has passed the university examination specified in par (3) (*b*).

22. Notice will be given, from time to time, of the number of cadetships which will be allotted half-yearly to university candidates. In case there should be more candidates than vacancies, the required number will be selected by competition among the said candidates at the ensuing July or December examination, but without a preliminary examination, except in geometrical drawing, which is obligatory. University candidates who may have been unsuccessful at their first examination will be allowed a second opportunity of competing, provided that "students" shall not have exceeded their twenty-second year, and that "graduates" shall not have exceeded their twenty-third year, at the time of such second examination. These limits of age will be ruled by July 1 for the summer, and by the January 1 for the winter examinations.

### 4. *Examination of Queen's and Indian Cadets, and Pages of Honour.*

23. Queen's cadets are sons of officers of the army, Royal Navy, and Royal Marines, who have fallen in action, or died of wounds received in action, or of disease contracted on service abroad, and who have left their families in reduced circumstances. They are appointed by the Secretary of State on the recommendation of the Commander-in-Chief or First Lord of the Admiralty.

24. Honorary Queen's cadets are sons of officers of the army, or Royal Navy, and Royal Marines, who were killed in action, or who had died of wounds received in action within six months of such wounds having been received, or of illness brought on by fatigue, privation, or exposure incident to active operations in the field before an enemy, within six months after their having been first certified to be ill. (See art. 5 of the royal warrant of November 27, 1873, clause 151, A.C. 1873.)

25. Applications for Queen's Cadetships and honorary Queen's cadetships should be addressed to the Military Secretary, if the candidate is the son of an officer of the army, or to the Secretary of the Admiralty, if the candidate is the son of an officer of the Royal Navy or Royal Marines.

26. Indian cadets are the sons of persons who have served in India in the military or civil service of her Majesty, or of the East India Company, and are nominated by the Secretary of State for India in Council, under the provisions of 21 and 22 Vict. c. 106, and 23 and 24 Vict. c. 100. Applications for Indian cadetships should be addressed to the Military Secretary, India Office.

27. A Queen's cadet, honorary Queen's cadet, Indian cadet, or page of honour, when ready for examination, will apply in the manner directed by par. 13 or 14.

28. Queen's cadets, honorary Queen's cadets, Indian cadets, and pages of honour, before admission to the Royal Military College, will be required to pass a qualifying entrance examination only —*i.e.* after having passed the preliminary examination under par. 15, they must obtain under par. 18 and 19 such an aggregate of marks as may indicate, in the judgment of the Civil Service Commissioners, a competent amount of general proficiency.

29. A Queen's cadet, honorary Queen's cadet, Indian cadet, or page of honour, who can produce a university certificate, as prescribed in par. 3 (*b*), will be exempted from the qualifying entrance examination described in the preceding paragraph.

### III. Terms of Payment.

30. The terms of payment for cadets of the Royal Military College are regulated by the following articles of the royal warrant of October 30, 1876 (clause 161, A.C. 1876). The payment to be contributed on behalf of a cadet at our Royal Military College shall be as follows:—

| | Annuity. |
|---|---|
| Queen's cadets . . . . . . . | Nil. |
| For an Indian cadet. By special arrangement with the India Office . . . . . . . . . | |
| For the son of an officer of the army or navy who has died in the service, and whose family is left in pecuniary distress (subject to the approval of our Secretary of State) . . . . . . . . . | £20 |
| For the son of an officer below the rank of colonel or regimental field officer in the army and captain or commander in the Navy, or of an instructor at the Royal Military Academy or Royal Military College or Staff College . . . . | 40 |
| For the son of a colonel or regimental field officer in the army, or of a captain or commander in the Navy, or of a professor at *the Royal* Military Academy or *Royal Military* College or Staff College . . . . . . . . . | £60 |
| For the son of a general officer who is not colonel of a regiment, or of a vice- or rear-admiral . . | 70 |
| For the son of an admiral, or of a general officer who is colonel of a regiment or in receipt of Indian colonel's allowances . . . . | 80 |
| For the son of a private gentleman . . . . . . . . . | 125 |

In determining the rate of payment—(*a*) A general officer on the half-pay of his last regimental commission shall pay in accordance with such regimental rank. (*b*) Officers who have sold their commissions shall be regarded as private gentlemen. (*c*) Officers on retired full or half-pay after twenty-five years' service, or officers of less than twenty-five years' service if placed on half-pay by reduction of establishment, or on account of ill-health, shall pay in accordance with their last substantive regimental rank. The cases of officers voluntarily retiring to half-pay before completing twenty-five years' service shall be specially considered. (*d*) Officers of the departments of our army and navy, according to their relative rank, of the permanent staff of the militia, adjutants of the volunteer force, as well as officers of our Indian military and naval forces, shall be treated on the same terms as military or naval officers. (*e*) The sons of deceased officers shall be contributed for in accordance with the foregoing regulations in regard to the rank or classification of their fathers. (*f*) Any change which may take place by promotion or retirement in the rank of the father of a cadet shall be notified to our Commander-in-Chief, and the contribution paid to the college on account of such cadet shall be regulated accordingly. If a cadet be absent a whole term in consequence of sickness or rustication, a payment of £10 shall be required for the privilege of his name being kept on the rolls of the establishment, and for a vacancy being kept open at the commencement of next term. In the case of a cadet who is an orphan, whose annual contribution is only £20, the amount to be paid when absence extends over a whole term shall be determined by our Secretary of State. The pay of a cadet shall be 3*s.* a day. It is issued to cover the expenses of regimental clothing, messing, washing, and other contingencies. All other necessary expenses which cannot be covered by his pay shall be chargeable to his parent or guardian in addition to the regulated contribution. If a cadet be absent from sickness during a portion of the term his pay shall continue to be issued and credited to his account; but no refund of the contribution shall be permitted. If a cadet be rusticated or removed during a term, his daily pay shall cease from the date on which he is sent away, and the contribution made for the half-year shall be forfeited. Each cadet other than a Queen's or Indian cadet, on first joining, shall be required to pay, in addition to the regulated contribution, a sum of £25 to cover the expense for uniform, books, &c., and to bring with him the articles of clothing of which he will receive notice, and which must afterwards be kept up at his own expense. He shall also be required to pay the regulated contribution in advance, for each half-year of the time during which he remains under instruction; and a deposit of £5 on account, for contingent expenses, which latter sum he shall be required to make up on returning to the Royal Military College after each vacation, to cover any expense that may be incurred on his account during the ensuing half-year.

'Revised army regulations for 1881 show a change in the terms of payment.

### IV. GOVERNMENT AND ORGANISATION.

31. The Commander-in-Chief will be the president of the Royal Military College.

32. An independent inspection by a board of visitors, appointed by the Secretary of State for War, and reporting to him, will be made once a year. Such visitors will not be a permanent body, but will not all be changed at the same time. The report of this board will be presented to Parliament.

33. The college will be under the control of a governor, appointed by and responsible to the Secretary of State for War through the Commander-in-Chief.

34. He will be assisted in the arrangement of the studies by a board, composed of the commandant and the professors or senior instructors of the different branches. The head of each branch will have the general power of supervision and inspection over the studies in his department, with the duty of reporting on them to the governor.

35. The governor will be assisted by a staff officer, who will be responsible in his temporary absence for the charge of the establishment. This officer will have the custody of the records and correspondence of the college, and will give the governor such assistance as he may require.

### V. DISCIPLINE.

36. The cadets will be subject to such rules and regulations as are, or may be, from time to time established for the maintenance of good order and discipline.

37. The governor will have the power of rustication and removal from the college, reporting the circumstances to the Commander-in-Chief.

38. In cases requiring more serious notice cadets will be liable, on the report of the governor to the Commander-in-Chief, to be removed from the list of candidates for commissions.

39. The name of any cadet expelled for misconduct will be recorded in the department of the Commander-in-Chief, and will be made known to the First Lord of the Admiralty, and to the Secretary of State for India, in order to prevent his being admitted into her Majesty's naval, military, or Indian service.

40. The cadets will be distributed in divisions of not less than twenty-five, each division being under the immediate charge of one of the professors or instructors selected by the governor.

41. The officers of divisions will be the channel of communication on all subjects between the cadets and the governor. They will reside in the college, and will exercise a strict superintendence over their divisions, for which they will be responsible to the governor. They and the

unmarried officers will mess with the cadets.

42. During the hours of study the cadets will be under the charge of the professors and instructors, to whose orders they will be required to pay implicit obedience.

43. The cadets will salute all officers, professors, and instructors, belonging to the college, whether in or out of the uniform, and all other officers when in uniform.

44. The professors and instructors will have certain limited powers of punishment, within and without the halls of study, at the discretion of the governor, to whom they will report all punishments which they may inflict.

45. No professor or instructor will be permitted to give private instruction to a cadet, either during the vacation or at any other time; or be allowed to prepare candidates for admission to the college.

46. The cadets will be required to appear at all times in uniform, except when on leave of absence, or when otherwise exempted by the governor.

47. The study undress may be worn at all times when cadets are under instruction, with the exception of riding or parade, when they will wear their uniform. The forage cap will be worn with the study undress.

### VI. COURSE OF INSTRUCTION.

48. Candidates for first appointments in the army who are successful in the examinations specified in the foregoing regulations will join the Royal Military College as cadets for one year, to be divided into two terms, during which the course of instruction will last. The college terms will be—(*a*) From February 10 to July 15, with suspension of study during a fortnight at Easter. (*b*) From September 1 to December 20. The intermediate periods will constitute the vacations.

49. The following subjects will form the ordinary course of obligatory studies —(*a*) Queen's regulations and orders for the army; regimental interior economy, accounts, and correspondence. (*b*) Military law. (*c*) The elements of tactics. (*d*) Field fortification, and the elements of permanent fortification. (*e*) Military topography, and reconnaisance. (*f*) Infantry and field artillery drill, riding, and gymnastics.

### VII. EXAMINATIONS FOR COMMISSIONS.

50. At the end of the course, the cadets will be required to pass an examination in the field and on paper, and those who pass a satisfactory examination, will, as provided in the royal warrant of October 30, 1876 (clause 161, A. C. 1876), become entitled to commissions in the army as second lieutenant, and will be gazetted to regiments in the order in which they pass.

51. Marks will be allotted to the obligatory subjects in the following proportions:—Queen's regulations, &c., 1½; military law, 2; elements of tactics, 3; fortification, 3; military topography and reconnaissance, 3; drill, gymnastics, and riding (one each), 3.

52. In tactics, fortification, and military topography and reconnaissance, one-fourth of the marks will be reserved for notes and drawings during the course.

53. The standard of qualification for a commission will be decided upon from time to time by the Secretary of State for War, and announced to the cadets at the commencement of the course.

54. In order to ensure due diligence during the whole period of residence, there will, at the end of the first term, be a probationary examination in the work of that term. A cadet failing to pass satisfactorily through the probationary examination at the end of his first term, will lose a term and not get class promotion. No cadet will be permitted to reside for more than one year at the college, except in cases of failure at the probationary examination, protracted illness, or long absence from any unavoidable cause, or of his being prevented by unavoidable cause from undergoing the final examination. In these cases an extra term will, if specially recommended by the governor, be allowed.

### VIII. INTERIOR ECONOMY, MESSING, &c.

55. The dining halls, halls of study, reading and recreation rooms, and quar-

ters of the cadets will be furnished in all essentials by the Government.

### IX. GENERAL REGULATIONS.

56. A cadet will be removed from the Royal Military College for moral or physical unfitness.

57. A cadet who fails to pass the examination at the end of his second term of residence will not be permitted to return to the Royal Military College, but will be allowed to be re-examined once at the next ensuing examination.

58. A failure at this re-examination will disqualify a cadet for a commission in the army, and his name will be at once removed from the list.

59. No person whatever belonging to the Royal Military College is to receive a present from any cadet, or friends of any cadet.

**Colour Service**—Means service in the ranks from the date of enlistment up to removal into the reserve.

**Commissariat**—The Revised Army Regulations of 1881 bring in new rules affecting this department which cancel those issued in 1876.

**Commissariat Department,** *vide* Revised Army Regulations, 1881, for the latest rules on the subject.

**Commissions**—The following regulations under which commissions in the Army may be obtained by subaltern officers of Militia are herewith given. They are issued with A. C., 1st January, 1881.

### 1. GENERAL CONDITIONS.

1. Commissions in the army will be granted to subalterns of militia regiments (Artillery, Engineers, or Infantry) who are successful candidates at a competitive examination in military subjects, and who fulfil the conditions hereinafter prescribed as to age, medical fitness, service in militia, and passing a literary examination.

### 2. TRAINING, &C., IN MILITIA.

2. A candidate will be required to have served two annual trainings, each training to be in a distinct year, and to have passed the examination and obtained the certificate, Army Form No. E 527 (late W. O. Form 748), required of a subaltern officer previous to the end of the second training after his appointment. The certificate must be obtained and the second training must have been actually completed before the date named in paragraph 17 for sending in the application for permission to compete.

### 3. LITERARY EXAMINATION.

3. A candidate for competition must also, subject to the exception stated in paragraph 12, have previously passed a literary examination before the Civil Service Commissioners, under the following rules:—

4. Examinations before the Civil Service Commissioners will be held twice a year, in the months of April and October. A fee of 1*l.* will be required from every candidate admitted to an examination.

5. A militia subaltern officer who is desirous of attending one of these examinations must apply accordingly to his commanding officer, at such a date as will allow of the commanding officer forwarding the application to the Military Secretary not later than the 15th February or 15th August, for the April and October examinations respectively. The commanding officer in forwarding the application will certify that the candidate is, having regard to the maximum limit laid down in paragraph 14, eligible in point of age, and that he will be prepared, when necessary, to recommend him in the manner prescribed in paragraph 16. Not more than three trials at these examinations will be allowed.

6. Each of these examinations will consist of a "preliminary" and a "further" examination, the latter of which will be proceeded with immediately on the conclusion of the former.

7. A candidate will be required at the preliminary examination to satisfy the Civil Service Commissioners in the following subjects:—

(1.) Mathematics,—viz. (*a*) arithmetic, including vulgar and decimal fractions, proportion, and simple interest.
(*b*) Euclid, Book I.

(2.) French, German, or some other modern language; the examination being limited to translation from the language, and grammatical questions.

(3.) Writing English correctly, and in a good legible hand, from dictation.

(4.) The elements of geometrical drawing; including the construction of scales, and the use of simple mathematical instruments.

(5.) Geography.

No marks will be allotted for the above preliminary examination, excepting for geometrical drawing, the maximum number for which will be 300.

8. The preliminary examination may be dispensed with in the case of candidates who have passed any previous examination before the Civil Service Commissioners in the same subjects, but it will be necessary for such candidates to attend again for examination in geometrical drawing if they wish to obtain in that subject marks which will count towards their aggregate in the further examination. Candidates will also be exempted from the "preliminary" examination, in all subjects except geometrical drawing, if they can produce (1) a certificate of having passed responsions at Oxford, or (2) the matriculation examination of the London University, or (3) the certificate of the Oxford and Cambridge Schools Examination Board, provided it embraces mathematics; if it does not include that subject, they will be required also to undergo an examination therein. Candidates who fail in the preliminary examination will be informed of their failure as soon as possible, and they will then be released from further attendance.

9. The subjects of the further examination and maximum number of marks obtainable for each subject will be as follows:—

| | Marks. |
|---|---|
| (1) Mathematics—viz., algebra up to and including quadratic equations; the theory and use of logarithms; Euclid, books I. to IV. and VI.; plane trigonometry; and mensuration . . . . | 3000 |
| (2) English composition, tested by *the power* of writing an essay, *letter, or précis*; English literature, limited to specified authors, and English history, limited to certain fixed periods; the authors and periods being notified beforehand . . . . . . | 3000 |
| (3) Latin . . . . | 3000 |
| (4) Greek . . . . | 2000 |
| (5) French; the examination to be partly colloquial . . . | 2000 |
| (6) German; the examination to be partly colloquial . . . | 2000 |
| *(7) Experimental sciences—viz., (*a*) chemistry and heat; or (*b*) electricity and magnetism . | 2000 |
| (8) General and physical geography and geology . . . | 2000 |
| (9) Drawing (freehand) . . . | 1000 |
| (10) „ (geometrical) . . | 300 |

Of these ten subjects candidates will not be allowed to take up more than four nor less than two, exclusive of freehand drawing and geometrical drawing.

10. In order to secure a proper proficiency in all the subjects taken up by a candidate, a certain number will be deducted from the marks gained by him in each subject except geometrical drawing.

11. To pass this examination a candidate must obtain, in the subjects which he takes up, such an aggregate total of marks as may, after the deduction above mentioned, indicate in the judgment of the Civil Service Commissioners a competent amount of general proficiency.

12. A candidate will be exempted from the "further" examination if he has previously passed an examination before the Civil Service Commissioners in the same subjects. A candidate will also be exempted from all examinations, except in geometrical drawing, if he can produce a certificate from the proper university authority that he has either (*a*) taken his degree in arts, or has passed the examination for the degree of B.A. or M.A. at one of the following universities, viz.:—

Oxford.
Cambridge.
Durham.
London.
Dublin.
Edinburgh.
St. Andrew's.
Glasgow.
Aberdeen.
The Queen's University, Ireland.

---

* Subjects (*a*) and (*b*) are alternative; a candidate will not be allowed to take up both.

or (*b*) passed one of the university examinations specified below, viz.:—

Oxford, "moderations."

Cambridge, "the previous examination."

Dublin, "the final examination of the senior freshman year," or, "the final examination of the School of Engineering."

Durham, "the first year's examination."

Queen's University, Ireland, "the first university examination in arts or in engineering."

Scotch Universities, "the examination for candidates for the army."

London University, the "first examination" for the degrees of B.A., LL.B., B.Sc., or M.B.

or (*c*) passed some other test which is accepted by the university as exempting from the above examinations.

13. A candidate producing a certificate under paragraph 12 will be required to attend one of the examinations referred to in paragraph 4 for the purpose of passing an examination in geometrical drawing. Permission to be obtained as in paragraph 5.

### 4. COMPETITIVE EXAMINATION IN MILITARY SUBJECTS.

14. Any subaltern officer of a militia regiment who may wish to become a candidate for an army commission will be allowed to compete, provided that he is recommended by his commanding officer, and is qualified under sections 2 and 3 of these regulations, and provided that he is within the ages of 19 and 22 on the 1st of January immediately preceding the competitive military examination which he may be allowed to attend.

15. These competitive examinations will be held twice a year, in the months of March and September, before boards of officers appointed for the purpose at the several stations named below. They will be held under the direction of the Director-General of Military Education, and due notice will be given of the days on which the examination will be held.

| England. | Scotland. | Ireland. |
|---|---|---|
| Colchester. | Edinburgh. | Dublin. |
| Aldershot. | | Belfast. |
| Devonport. | | Cork. |
| Dover. | | |
| Portsmouth. | | |
| York. | | |

16. The application of a militia subaltern officer to be admitted to the competitive military examination will be submitted through the officer commanding his regiment, who will state whether he can recommend the officer as a fit and proper person for a commission in the army; and in forwarding the same, the officer commanding the sub-district and the general officer commanding the district will also state their opinion of the candidate. In the event of the officer commanding the regiment being unable to recommend the candidate, the special reasons will be stated.

17. The application must be forwarded to the Military Secretary, Horse Guards, War Office, prior to the 1st January and 1st July, respectively, after which dates no application will be entertained, and should be accompanied by—

(*a*) Certificate of birth, or, in default, a declaration made by one of the candidate's parents or guardians before a magistrate, giving his exact age. A certificate of baptism cannot be accepted in lieu of a certificate of birth.

(*b*) Certificate of having served two annual trainings (each training in a distinct year). (See paragraph 2.)

(*c*) The certificate, Army Form No. E 527 (late W.O. Form 748), showing also the date on which the finding of the board which granted the certificate was approved.

(*d*) A certificate from the Civil Service Commissioners that the candidate has passed the examination described in paragraph 9; or, an university certificate as prescribed in paragraph 12, together with a certificate from the Civil Service Commissioners that the candidate has qualified in geometrical drawing.

(*e*) The candidate's address, and an intimation as to which of the stations named in paragraph 15 he wishes to attend at for examination.

18. After the receipt of the application and documents referred to in paragraph 17, instructions will be issued in due time to the candidate as to the place and time at which he will be required to present himself for the competitive military examination. After these instructions have been issued no change in the station for examination will be permitted.

19. Subject to the rule as to age in paragraph 14, candidates will be allowed three trials only. Unsuccessful candidates who wish to compete again must apply for permission through their commanding officer, stating any change in their address or in the station at which they wish to be examined, but the other certificates need not be repeated.

20. All candidates will be inspected by a medical board immediately before the competitive examination; and no candidate will be considered eligible for a commission unless certified by the board to be free from any bodily defects or ailments, and in all respects, as to height and physical qualities, fit for Her Majesty's service.

21. The subjects of the competitive examination and the maximum marks obtainable in each subject will be as follows:—

| | |
|---|---|
| 1. The elements of field fortification | 600 |
| 2. Military topography . . | 600 |
| 3. The elements of tactics . . | 600 |
| 4. Military law. . . . | 600 |

22. In addition to obtaining a sufficiently high place in the order of merit, a candidate will be required to obtain in any case ·25 of the marks in each subject, and ·5 of the aggregate.

23. The scope will be that embraced by the synopsis of the course of instruction (in the subjects specified in paragraph 21) at the Royal Military College. There will, however, be no practical out-of-door examination in any subject. The text books will be those in use at the time at the Royal Military College, which, for the present, are as follows:—

| | |
|---|---|
| 1. The elements of field fortification . . | Philips' Course of Artillery and Fortification. |
| 2. Military topography . | Paterson's Notes on Military Surveying and Reconnaissance. |
| 3. The elements of tactics . . | Field Exercises.<br>Clery's Minor Tactics. |
| 4. Military law . | Army Act, July 1881.<br>Queen's Regulations.<br>Elements of Military Administration and Law (Boughey). |

24. Until further notice, 60 army commissions will be allotted to the successful competitors at each of the half-yearly competitive examinations.

25. The names of the successful competitors will be published in order of merit, and each competitor will be informed of his place on the list, and the credits obtained by him in each subject.

26. The principle under which these commissions are offered being that of pure competition, it follows that candidates who, from their position on the list, are not successful in obtaining a commission, will not have any subsequent claim thereto, without undergoing another competitive examination.

**Compulsory Retirement**—Compulsory retirement means the limit of age in every rank at which an officer is now required to retire from the Army. A Lieutenant or Captain who does not receive half-pay promotion (except in the Engineers) at 40; a Major at 48; a Lieutenant-Colonel at 55; a Colonel at 55; a Major-General at 62; a Lieutenant-General at 67; or a General at 67, are compulsorily retired. In addition to compulsory retirement for age, continuous non-employment will also involve compulsory retirement.

**Confidential Reports,** *vide* Queen's Regulations, 1881.

**Corps**—Means, according to the Army Act, 1881, and in the case of H.M.'s regular forces, any such military body, whether known as a territorial regiment, or by any different name, as may be from time to time declared by Royal Warrant to be a corps for the purpose of the Act, and in a body formed by Her Majesty, and either consisting of associated battalions of the regular and auxiliary forces, or consisting wholly of a battalion or battalions of the regular forces, and in either case with or without the whole or any part of the permanent staff of any of the auxiliary forces not included in such military body. The application of the term is further explained in the Act referred to.

**Corps d'Armée**—Under the head "Army," a corps d'armée is explained. According to the Revised Army Regulations, 1881, a corps d'armée, for service abroad, will always be kept ready of the following strength: 12 battalions of Infantry at home, 6 battalions in the Mediterranean, 3 battalions of Guards, 6 regiments of Cavalry, and 17 batteries of Horse and Field Artillery.

**Corps of Commissionaires**—Its ranks are not confined to military pensioners alone, but all who have completed their engagements with credit in any branch of her Majesty's naval or military service are eligible for admission.

**Court-Martial**—Add in Dictionary under head of court-martial, *summary court-martial*, which is now introduced in lieu of field-general courts-martial, and may consist of three, or even two officers, if the former number be not available; but no sentence of death can be carried out without approval of the General commanding. The constitution of courts-martial has been greatly changed of late. *Vide* Army Regulations.

**Court-Martial, Field-General**—Constituted for the trial of an offender in any detachment or portion of troops in any country beyond the seas, where, in the opinion of the convening officer, the offence to be tried is not practicable by an ordinary court-martial. Such court-martial shall consist of not less than three officers.

**Curved or Indirect Fire**, as defined by a committee appointed by the War Office in 1877 to consider the meaning of certain artillery terms, means "fire from guns with reduced charges, and from howitzers and mortars at all angles of elevation not exceeding 15°."

## D.

**Defaulter Book**—Queen's Regulations for 1881 give in extenso the mode of keeping this book.

**Deferred Pay**, *vide* Pay deferred.

**Derrick**—For large ordnance of 9-inch calibre and upwards a movable derrick is attached to the muzzle of the gun for the purpose of lifting the charge. The derrick is made of bronze.

**Direct Fire**—Means fire from guns with service charges at all angles of elevation up to 15°.

**Discharge**—Besides the different circumstances mentioned in the Dictionary under the head "Discharge," under which the discharge of a soldier may be granted, there is that of a recruit, who may claim the same within three months of enlistment on the payment of £10. *Vide* Queen's Regulations, 1881.

## E.

**Enemy**—This expression includes all armed mutineers, armed rebels, armed rioters, and pirates.

**Engineers**—*Vide* Revised Army Regulations, 1881, for the changes which have been lately introduced into this regiment and department. The organization of the regiment is by companies, not by battalions as shewn in the Dictionary. There are now 43 companies, 2 troops, and depôt troops.

**Enlistment**—The term of service for all arms is as follows:—long service, i.e. 12 years Army service, or short service for 6 years; 7 years Army service and 5 years Reserve service, which will be converted into 8 years service with the colours, and 4 years Reserve service, if the period of Army service expires while the man is serving abroad. All enlistment will be for short service, with some exceptions — *vide* Queen's Regulations, 1881.

**Enlist, To**—In the body of the Dictionary the meaning of this term is given. According to the Revised Army Regulation of 1881; except in the case of boys under sixteen years of age, no recruit will be enlisted who has not completed nineteen years, or attained the physical equivalent of that age.

No soldier will be sent to India or the tropics under twenty years of age, or with less than a year's service.

In place of the various terms of colour service and reserve service for which soldiers now enlist in the several arms, enlistment will be uniform for seven years with the colours, and five years in reserve. The only exception will be the Household Cavalry, who will be enlisted for twelve years with the colours, and artificers and boys for all arms. In the case of soldiers serving in India, service will be extended to eight years, and elsewhere abroad it may be so extended.

**Emergency, National**—Means when England is invaded, or the state of the country is such as to require an increase of officers, then retired officers, or those who have commuted, will be re-called to serve.

**Establishment**—According to A. C. Clause 55, of 1881, all Infantry regiments placed under orders for service abroad, will have their establishments increased by 4 lieutenants; those having an establishment of 800 rank and file, or upwards, being also increased by eight sergeants.

This term is further explained in the body of the Dictionary; it is also applied to the strength of the regular army as made up yearly. A detail showing the strength of regiments at home and abroad and of the disembodied militia will be found in the army circulars.

**Exchanges**, *vide* Queen's Regulations, 1881.

**Examination of Ordnance**.—The 40-pr. and smaller guns, whether breech-loading or muzzle-loading, are to be examined after every 150 rounds.

## F.

**Field Day**—When troops move out for instruction in field exercises and evolutions, this is termed a field day.

**Field Officer in Brigade Waiting**—The officer so styled is an officer of the Guards. He is an important personage, and if his duties are more courtly than military, they are none the less distinctly limited and defined. The office belongs to the ten field officers of the brigade, who act in turn for a month at a time. The Field Officer in Brigade Waiting is attached to the Court, and is in official communication with the Lord Chamberlain. It is his duty to attend the Queen upon certain state and semi-state occasions, and he has a place assigned to him at all balls, concerts, and other entertainments, and in processions his position is "close to the hind wheel of the royal carriage." At drawing-rooms and *levées* the Field Officer in Brigade Waiting "will have," say the rules, "an audience of Her Majesty to deliver the state of the brigade and receive the parole of the day," a privilege which, though very formal, is certainly honourably special. Practically speaking, the Field Officer in Brigade Waiting is a kind of extra equerry to the sovereign, and his special duty is to look after the guards of honour which are called out to attend royalty upon state occasions. He has an adjutant in waiting attached to him to carry out his orders, whose position is also clearly defined—the adjutant's place being in the hall and lobby, while his superior officer is in the ballroom or royal box, as the case may be.

**Flag Stations**—Stations of the Army at which the national flag (Union Jack) is permitted to be hoisted daily or on privileged days.

**Forage Cap**—A new forage cap has been introduced for the cavalry; each class—dragoons, hussars, and lancers—having a distinctive badge.

**Forage Cap (Glengarry)**—In marching order to be kept in the valise.

**French Rifled Gun**—Steel guns now form the light ordnance in the French service.

**Furlough**—On this subject the reader is referred to Queen's Regulations, 1881, in which he will find information on all points relating to H.M.'s forces.

**Fuze**—A time fuze, wood Boxer, M.L. 15-second, has been introduced into the service, which is intended to supersede the 5- and 9-second fuzes.

**Fuzes** — The ordinary metal with which the fuzes used in the base of the Palliser shell is made being found too soft, steel fuzes have been substituted, together with some of "hard metal." The latest fuzes are constructed on the "delayed action" principle lately introduced, causing the shell to explode 4 seconds after impact, and some highly sensitive fuzes for high angle fire have been forwarded for use. The result of experiments with these new fuzes has been highly satisfactory.

## G.

**Garrison**—Under this head in the Dictionary, substitute for 151 line battalions, 3 regiments of Guards of 2 battalions each, and 71 regiments of 2 battalions (linked). In this number is included the Rifle Brigade, which has a greater number of battalions—*vide* Army List.

**Gas-check**—Used with Palliser projectiles and common shells for 12·5-inch, 12-inch, 11-inch, 10-inch, 9-inch rifled M.L. guns, and other smaller natures of projectiles. Gas-checks are found to prevent the escape of gas and to operate most beneficially in extending the range and in centring the projectile, and thus preventing any great deviation in flight. Further, they enable the projectile to rotate without the aid of studs. They are made of copper and attached to the base of the projectile.

**Geneva Convention**—The Turks use the red crescent as a distinctive mark, instead of the red cross as in European armies.

**Ghurrie**—This name, besides the definition given of it in the Dictionary, is also given to the keeps or small citadels built for the protection of Indian native villages. The walls are made of unctuous clay, oily straw called koodrau, linseed, and gall nuts. Such mud walls resist rain, and in the days of smooth-bore artillery, resisted the penetration of shot to some extent.

**Ginjal**—An Indian term for a long matchlock. Ginjals are of various calibres, and are used as wall-pieces by the natives of India: they are commonly fixed like swivels, and carry iron balls not exceeding a pound in weight; in the field they are sometimes fixed on the saddles of camels.

**Good-Conduct Pay**—Page 167 left-hand column, 19th line from bottom of page, strike out "corporal." G. C. pay will not in the future be given to second corporals, bombardiers, or artificers with the rank of corporal, except to those whose present pay, including G. C. P., exceeds new rates. The recent orders on G. C. badges and pay will be found in the Revised Army Regulations for 1881.

**Gratuities**—Appendix J of the Dictionary gives the gratuities to soldiers on discharge. Later rules have since been issued, and two new paragraphs added, rendering the following corrections and insertions necessary: Page 556 of the Dictionary, par. 4, 2nd line, for "twenty" read "ten." Line 4, for "£3" read "£1 10s."; line 6, for "£4" read "£2"; line 7, for "£5" read "£2 10s." Par. 5, 1st line, after "sergeant" insert, "which term includes sergeants-major, and all other grades of sergeants."

9. The gratuities issued in accordance with these regulations will be charged in the accounts of the accountant from whom the soldier may be drawing his pay at the time of discharge. The soldier will sign a receipt for the gratuity; and in each case in which the sum of £2 or £2 10s. is awarded, the charge will be further vouched by a certificate of the officer commanding that the soldier has not been recorded as guilty of drunkenness during the 10 years immediately preceding his discharge. In the case of a non-commissioned officer referred to in par. 8, the certificate for the period during which he has been detached to the auxiliary forces will be signed by the adjutant and countersigned by the commanding officer of the regiment or corps with which he has been serving.

10. In the case of a soldier dying in the service, his estate will receive credit for such amount of gratuity as he would have been entitled to had he been discharged from the army on the day previous to the date of his death. These gratuities will be charged in the regimental pay list on the same form or voucher as those issued to men on discharge, vouched by a reference to the non-effective account in which the credit is given.

11. Clause 12, A.C. 1875; clause 114, A.C. 1874, so far as it relates to the gratuities from the general fund formed from the fines for drunkenness; clause 3,

A.C. 1875; and clause 17, A.C. 1876, are hereby cancelled.

The attention of the Military reader is especially called to clause 189 of A.C. of November 1878 on the subject of the gratuity to men specially extending their service.

**Gymnasium**—A place where athletic exercises are performed. A school of instruction in gymnastics is formed at Aldershot, where officers and men desirous of being instructed and becoming instructors in their regiments, are sent. Queen's Regulations give all information on the subject.

## H.

**Half-pay**—For the conditions and rates accorded to half-pay, *vide* royal warrant of 1st July, 1881. Half-pay is limited to officers on the active list.

**Havresack**—Future issues of havresacks for rifle regiments will be black instead of green.

**Helmet**—It is shown in the body of the Dictionary that helmets are only worn partially in the army. A new helmet has now however been introduced for the whole army. It is made of felt, with a brass spike or knob on the top. For Indian service a wicker helmet has been found more suited to the climate.

**Horse**—Para. 2 right-hand column, page 191, of the Dictionary, read "horses will be purchased at such rates as shall from time to time be determined and sanctioned by the Secretary of State for War."

**Hospital, Military**—Regulations relative to station hospitals will be found in A.C. February 1878.

**Hospital, Permanent**—The latest instructions on the subject of permanent hospitals, state that the minimum space to be allowed to each bed is 1200 cubic feet at home and in temperate climates, and 1500 cubic feet may be specially authorised at stations in tropical climates. In detached wooden houses in temperate climates, the minimum of space will be 600 cubic feet for each bed.

## I.

**Infantry**—Under this head in the Dictionary, expunge at page 200, 16th line from top of page, left-hand column, "The majority" to the end of the sentence, and add, "All regiments are now linked, and include 2 or more militia battalions, designated the 3rd, 4th, and succeeding battalions, though in many cases at present, only 1 battalion, the 3rd, has been formed.

**Iron Rations**—This term is applied to the supplies taken and carried by the troops themselves on service beyond the sea, when detached from their transport. The ordinary iron rations for two days should be 2 lbs. preserved meat and 2 lbs. biscuits, supplemented in such manner as circumstances admit.

## J.

**Jury**.—A number of freeholders or householders, selected in the manner prescribed by law, who are impanelled and sworn to inquire into and try any matter of fact.

Officers as well as soldiers are exempted from serving on juries; but if summoned must attend and explain that they are not amenable to serve.

## K.

**Kneller Hall**—A school of music maintained by the Government for the purpose of training N. C. O.s and privates as bandmasters and bandsmen.

## L.

**Ladders, Escalading**—The new pattern is made in 8½-foot lengths. It is intended to be used for escalading heights not exceeding 16 feet, and also as an ordinary ladder in greater lengths for the demolition of houses, the construction of light temporary bridges, &c.

**Lancers**—The numbers of the regiments comprising the Lancers are the 5th, 9th, 12th, 16th, and 17th. Carbines are now issued to Lancer regiments: also a double-barrelled breech-loading pistol in place of the weapon hitherto in use.

**Lance-Sergeants and Corporals**—Add at the end of the sentence of this term in the Dictionary, "They are designated during the time they are acting in this position: provisional lance-sergeants and corporals."

**Lasso** — The new lasso equipment having been issued for the use of the cavalry regiments at home, the whole of the duty non-commissioned officers and six men per troop are to be instructed in its use, and should a man become ineffective, by promotion or otherwise, for this duty, he is to be replaced by another man. The lasso is to be carried by the horses which have been trained to the use of it. One lasso, 30 feet in length, will be supplied to each troop of cavalry, in exchange for one of the 20 feet lassoes now in possession.

**Lieutenant**—The commission of lieutenant is now granted to all officers entering the army, militia, or volunteers.

**Lieutenant-Colonel** — Appointed as such to the cavalry or infantry, shall be placed on half-pay after the periods of full-pay service stated below, reckoned from the date on which he was appointed to serve in the regimental rank of lieutenant-colonel—

(*a*) If appointed before the 1st July, 1881, after five years; unless he prefer to vacate his appointment after four years, in which case he shall be eligible for retirement on a colonel's pension.

(*b*) If appointed on or after the 1st July, 1881, after six years' service as lieutenant-colonel, or after less than six years, if four years' service shall have been completed in command of his regiment.

For the rules appertaining to the promotion, &c., of field officers, *vide* Revised Army Regulations.

**Line of Communication** — For the organisation of the line of communications of an army in the field, *vide* A.C. of June 1878.

**Litters**—A pair weighs 3 qrs. 22 lbs.

## M.

**Major**—*Vide* Revised Army Regulations for 1881.

**Marines, Royal**—The following revised regulations for admission to the Royal Marine Artillery have been issued by the Admiralty:—

1. Admission to the Royal Marine Artillery as probationary lieutenants will be granted to the successful candidates in order of merit (according to the number of vacancies) at the open competitive examinations for admission to the Royal Military Academy at Woolwich. The examinations will be conducted by the Civil Service Commissioners, and will be held twice a year, namely, in July and December.

Candidates who have received permission from the Horse Guards to attend the examination, and who are desirous of obtaining an appointment in the Royal Marine Artillery, should send in their names to the Secretary of the Admiralty, to whom all inquiries on the subject should be addressed.

2. The limits of age will be from sixteen to eighteen, the candidates being required to be within those limits on the 1st day of the January next following for the winter examination, and on the 1st July for the summer examination. They must be 5ft. 5in. in height.

3. The successful candidates will be appointed lieutenants on probation. They will proceed to the Royal Naval College, Greenwich, on October 1, and after the Easter vacation.

4. Two examinations of probationary lieutenants will be held in each year at the Royal Naval College, Greenwich. Those who pass a satisfactory examination at the end of the first session after entry will remain at the College for another session, at the end of which they will be again examined, and, if they pass satisfactorily, will receive commissions in the Royal Marine Artillery, in order of merit, bearing date from the time they receive their probationary appointments.

5. Probationary lieutenants who do not pass a satisfactory examination at the end of the first session after entry will be finally excluded from the Royal Marines. Those who, after passing the first examination, finally fail to qualify for the Royal Marine Artillery, may receive commissions in the Royal Marine Light Infantry, bearing the same date as the infantry officers who passed the army examination at the same time, but be posted below them.

6. Artillery officers will be posted on the list of their corps in the order in which they pass their final examination at Greenwich.

7. Officers of the Royal Marine Artillery on probation will receive 5s. 3d. a day. Those who are permitted to remain after the first session will be allowed 1s. 6d. a day mess allowance until the expiration of their period of study at Greenwich.

8. Officers, on passing out, will be attached to H.M.S. *Excellent* for a course of gunnery and torpedo instruction, on the conclusion of which they will join headquarters, and be instructed in their drill and military duties for service ashore and afloat.

9. Each successful candidate at the examination for entry, must deposit the sum of £80 with the Accountant-General of the Navy before he can be appointed lieutenant on probation for the Royal Marine Artillery, to provide for his equipment at the Royal Naval College, and on joining his division.

10. The uniform of officers on probation will be blue patrol-jacket, blue working-jacket, blue mess-jacket, and scarlet waistcoat, *undress* trowsers, sword, sword-belt, and forage-cap.

### LIGHT INFANTRY.

1. Admissions to the Royal Marine Light Infantry will be granted to the successful candidates, in order of merit (according to the number of vacancies), at the open competitive examinations for admission to the Royal Military College at Sandhurst.

The examinations will be conducted by the Civil Service Commissioners, and will take place twice a year, in the months of July and December.

Candidates who have received permission from the Horse Guards to attend the examination, and who are desirous of obtaining an appointment in the Royal Marine Light Infantry, should send in their names to the secretary to the Admiralty, to whom all inquiries on the subject should be addressed.

### *Age, &c.*

2. The limits of age for candidates for admission by competition will be from seventeen to twenty; for students of the universities, who shall have passed the interim examination, from seventeen to twenty-one; for graduates of the universities who shall have passed the examination for the degree of B.A. or M.A., from seventeen to twenty-two; and for lieutenants from the militia, who are eligible for commissions in the army as lieutenants, and are recommended by the Horse Guards, from nineteen to twenty-two. They must be 5 feet 5 inches in height.

3. Candidates must be within the prescribed limits of age on the following dates:—Candidates for admission by competition on January 1 next following the winter examination, and on July 1 for the midsummer examination. Lieutenants from the militia on May 1 of the year in which they are recommended for a commission.

4. The successful candidates will be appointed lieutenants in the Royal Marine Light Infantry, and will be posted on the list of their corps in the order in which they passed their examination. They will join their respective divisions at once, and be instructed in their drill and military duties for service ashore and afloat. They will also undergo a course of garrison or military instruction.

5. Each successful candidate at the examination for entry must deposit the sum of £80 with the Accountant-General of the Navy before he can be appointed lieutenant in the Royal Marine Light Infantry, to provide for his equipment on joining his division.

**Married Roll** — Explained in Dictionary, but the following regulations for soldiers on the married establishment and their families were issued in A.C. December 1876, and since then further regulations have been issued in A.C. April 1877 and June 1877, as shown in the circulars alluded to.

### REGULATIONS FOR SOLDIERS ON THE MARRIED ESTABLISHMENT AND THEIR FAMILIES.—*Clause* 165.

1. The service of the larger proportion of the soldiers in the army having been reduced to six years, they become under par. 5 of the Married Soldiers' Regulations (clause 53, A.C. 1871), ineligible to have their names placed on the married roll. The following regulation readjusting the numbers to be borne in future on the married establishment will be accordingly substituted for par. 1, clause 53, A.C. 1871.

### 1. *Establishment.*

1. The married establishment of the non-commissioned officers and men of our army and its departments serving at home and abroad (India excepted) will be composed as follows, and will be designated the "*Married Roll*":—

(*a*) All non-commissioned officers and others included in class 1 of the royal warrant of November 26, 1875 (clause 161, A.C. 1875), and also those included in class 2 of the same warrant, with the exception of the troop, battery, or company sergeants, of whom only the proportion specified in (*b*) will be borne on the married roll.

| | |
|---|---|
| (*b*) 3 out of 4 or 5,<br>4 „ 6 or 7,<br>5 „ 8 or 9,<br>6 „ 10 (and in the same proportion for any higher numbers) | Troop corporal-majors, troop sergeant-majors, battery sergeant-majors, battery quarter-master-sergeants, colour-sergeants, company sergeant-majors, troop staff-sergeants, Royal Engineer train, sergeants of each troop, battery, or company, corporals in the household cavalry, and non-commissioned officers holding the rank of sergeant in army establishments.<br>These proportions, in regard to each troop, battery, or company, will be calculated upon the establishment, and not upon the actual strength. |

(*b*) 3 out of 4 or 5,
4 „ 6 or 7,
5 „ 8 or 9,
6 „ 10 (and in the same proportion for any higher numbers)

(*c*) Four per cent. of trumpeters, drummers, and rank and file, to be calculated upon the establishment of the corps.

2. To these rules there are the following exceptions:—

(*a*) [Cancelled.]

(*b*) In the Royal Engineers, the calculation under par. 1 (*b*) will be made upon the establishment of the whole corps.

(*c*) In the supply and ordnance store branches of the Army Service Corps, the calculation will be made upon the whole establishment of these branches separately, and not upon the establishment of each company.

(*d*) The married roll of the coast brigade will be 50 per cent. of its establishment.

3. The reduction in the present numbers of the married roll will be effected by absorbing every alternate vacancy until the establishment is in accordance with the amended scale.

4. At home stations the following daily ration allowances will be issued to families on the married roll, when the troops are compulsorily and necessarily separated from them on duty, except when employed on the recruiting service:—

| | |
|---|---|
| To each wife, in lieu of a half-ration . . . . . . . . | 3d. |
| To each child under fourteen years of age, in lieu of a quarter-ration . . . . | 1½d. |

Such ration allowances, however, will not be issued to the families of lunatic soldiers, or of soldiers in hospital, or of soldiers employed as officers' servants.

5. The allowances granted by par. 4

will not be issued unless the period of separation exceeds four days. When the period exceeds this limit, the issue will be made, but only from the fifth day inclusive.

6. Pars. 1 and 47, clause 53, A.C. 1871; clause 102, A.C. 1871; and clause 49, 1876, are hereby cancelled.

*A.C. April*, 1877.

1. The reduction in the present numbers of the married roll of regiments required by par. 3, clause 165, A.C. 1876, will not commence until all who were married with leave, prior to December 1, 1876, have been absorbed into vacancies or been disqualified for the married establishment.

2. A report will be made by every corps to the War Office showing in detail the number of men who were married with leave before the above date, and who are awaiting absorption in the married establishment.

3. The married establishment of the Household Cavalry and Army Hospital Corps will form an exception to par. 1 (*c*) of clause 165, A.C. 1876, and will, as heretofore, be 7 per cent. of trumpeters, drummers, and rank and file, calculated upon the establishment of the corps.

4. The four senior collarmakers and four senior wheelers in each brigade of Royal Artillery [horse and field] will be eligible for the married roll after five years' service in their respective ranks. Par. 5, clause 53, A.C. 1871, will be amended accordingly.

*A.C. June*, 1877.

1. In the Royal Artillery the calculation of the numbers on the married roll under par. 1 (*c*) of clause 165, A.C. 1876, will, for the future, be made on the establishment of each battery, and the roll will be kept by battery instead of by brigade.

2. Par. 2 (*a*) of clause 165, A.C. 1876, is hereby cancelled.

The married establishments of the West India regiments and Royal Malta Fencible Artillery will form an exception to par. 1 (*c*) of clause 165, A.C. 1876, and will be 7 per cent. of the trumpeters, drummers, and rank and file, calculated upon the respective establishments of those corps, and the same with the mounted military police.

**Mauser Rifle**—Forms the arm of the whole German army, both rifle and carbine; the latter to the cavalry.

**Medal, Humane**—Granted by the Humane Society for saving life. These medals are permitted to be worn by officers in uniform. The medal is directed to be worn on the left breast.

**Medical Department**—Vide Revised Army Regulations, 1881, vol. i.

**Mess Allowance**—The latest orders on the subject will be found in A.C. for November, 1878, clause 184.

**Military Decorations** — Means any medal, class, good-conduct badge, or decoration.

**Military Reward**—Means any gratuity or annuity for long service or good-conduct; it also includes any good-conduct pay, or pension, or any other military pecuniary reward.

**Militia** — The Queen's Regulations should be consulted as regards the organisation of this service, certain changes having taken place since the insertion of the subject in the Dictionary.

**Militia Recruits**—With reference to the recruiting for the militia, it appears that the War Office authorities have recently decided that the recruiting arrangements in militia regiments are to be regulated by officers commanding the sub-districts. The recruiting-sergeants, if possible, whenever necessary, are to reside about stations, and will be occasionally visited by the adjutants of their respective corps, under the authority of the officer commanding the sub-district. The recruits thus raised for militia regiments will be examined by an army medical officer wherever available near the place of enlistment; when not available, the examination will be made by the militia medical officer, or the nearest civil practitioner who is registered for the examination of recruits, preference being given to the former when equally accessible. Routes, when necessary, will be issued by officers commanding the sub-district. It is, however, unnecessary to issue routes when the party returns the same day; should it, on the other hand, remain out for one night or more, a route will, of course, be necessary for it to obtain billets.

**Model**—With the view of illustrating what Lieutenant-Colonel Brackenbury, R.A., brought forward some little time since on the subject of minor tactics, it is thought desirable to insert in this Supplement the excellent method of studying minor tactics, which Captain Wilkinson Shaw, 102nd Fusiliers, has introduced at Aldershot by means of modelled ground. The following is the description of his model as taken from the *Times*:—"A large model of ground, 22 feet in length by 15 feet in width, has been constructed, standing about the height of a table from the floor of the lecture-room. The scale is 20 yards to an inch, or 88 inches to the mile, the vertical heights being exaggerated as 1½ to 1. The ground is mostly ideal, but so designed as to present the varied kinds of country of ordinary English type necessary to illustrate the secondary operations of war. The model being to scale, 3 miles long by 2 miles wide, it follows that 6 square miles of ground are shown thereon. The difficulty of getting to the centre of a large model for purposes of painting, cleaning and repairing, has been met by a special arrangement of the framework, the centre portion of which is stationary, the remainder, divided into four wings, two at each side of the centre frame, opening out to an angle sufficient to admit a person between any two portions as required. The wings, which are 15 feet (the width of the model) long, by 4 feet wide, are pivoted at one end, and move out on iron racers something after the manner of a traversing platform. There are thus four sections across the length of the model, but when closed up the wings fit exactly so that no division in the ground is perceptible. The surface of the model is formed of a mixture of three parts of lime to two parts of sand and two and a half parts of plaster of Paris, spread nearly ½ inch thick, over a substratum of damp sand beaten down hard and modelled to the desired contours of the ground. The surface composition sets, so far, in about three days as to enable the final modelling of details to be effected, and the elevations of hedges, *trees*, &c. to be fixed, by letting them in a portion of their height. When the surface has quite dried out, in about a week's time, it is sized with two coats of thin glue, and is then ready for painting. It requires two or three coats of oil paint, the colours being light green for fields and downs, dark brown for ploughed fields, the surface being previously scored in drills, various shades of green for trees, light brown for roads, very bright shade of purple for heather, and light blue for water. Finally, the houses, which are cut out in soft wood, and painted red and slate colour, are fixed on with strong glue. The blocks representing troops are cast in lead, and fairly to scale so far as frontage and depth go. Individual scouts, sentries, or vedettes are exaggerated in size, so as to be seen on the model without difficulty. Guns are only to scale so far as their total length when limbered up is concerned. Small parties of cavalry, not to scale as regards depth, have also been added as a matter of convenience. Vertical heights are, of course, exaggerated; and the blocks, while coloured red or blue on the upper surface, to distinguish the troops of one side from the other as in the war game, are painted white at the sides, so as to show out clearly wherever placed, on the green, heather, and brown tints of the modelled ground. The lecturer and his assistants move the blocks on the model, as required, by means of bamboo rods or pointers with a magnetic tip, a small piece of soft iron being let into each block to facilitate this arrangement. As a general rule, therefore, the model does not require to be opened out during demonstrations, but should the lecturer for any special purpose wish to enter between the wings he can easily do so. By means of a model of ground constructed on these principles, studies in the minor operations of war can be illustrated with a minuteness of detail hitherto not much practised in our service. In the case, for example, of a small reconnoitring party, it is possible to show the exact position and route followed by each man. The exercises given in a course of study will be very elementary at first, but will gradually be increased in importance, so as to finally illustrate the tactical movements of small forces of the three arms combined, under varying conditions. Sometimes the troops of one side only will be shown, at others opposing forces will be allowed to come in contact. The object of such studies will be to accustom the student to the position of leading small bodies of troops, and to force him to make up his mind as to a course of action under given conditions; and more than this, it will practise the commander in the art of carrying out his own designs when once he has determined upon them. In other words, he will learn not only what to do, but how to do it. Having gone through a course on this system it is confidently expected that the officer or non-commissioned officer will be enabled to profit by subsequent exercises in the field, to a degree that he would not otherwise have done."

**Mountain Artillery**—To be added to the list of M. T. guns is the *screw* gun, which takes in two, being fastened together by a screw, hence its name. The screw battery did excellent service in the last Afghan war, and was easy to carry, from being in two pieces.

**Musketry Regulations**—The following are the musketry regulations, which became also applicable to the volunteer force:—

I. With a view of improving the system of musketry training in the army, and of developing the shooting powers of the soldier with the Martini-Henry rifle, the following alterations in the course hitherto prescribed for the drilled soldier and recruit have been approved.

II. The number of targets to be fired at by the several classes in individual practice, the size of the bull's-eye and centre, which are to be circular in form, the distances to be fired at, the position and number of rounds at a distance, and the number of points to be obtained to pass from one class to another, and to qualify as a marksman, are to be as follows:—

DRILLED SOLDIERS.

| Period and Distances in each. | Position. | Number of Rounds at each Distance. | Points to be obtained in each Class with the | |
|---|---|---|---|---|
| | | | Martini-Henry. | Snider. |
| 1st period 200<br>300 .. .. .. | Standing<br>Kneeling | 10<br>10 | 40 | 40 |
| 2nd period 500<br>600 .. .. .. | Any | 10<br>10 | 40 | 30 |
| 3rd period, 1st class 700<br>800 .. .. .. | Any | 10<br>10 | 40* | 25* |

* To qualify as marksmen.

III. The targets for volley and independent firing will remain as at present.

IV. The target for skirmishing will be 2 feet high and 6 feet broad, with a black mark in the centre 2 feet square.

V. The targets to be fired at by the recruit will be the same as for the drilled soldier; but the number of rounds at a distance, the distances to be fired at, and the number of points to be obtained in each class, will remain as at present laid down for each rifle.

VI. Recruits will not in future perform position drill in "marching order" or with "fixed bayonets."

VII. The number of points fixed as the value of the hits in each class, and in the volley, independent and skirmishing practices, will remain as at present.

VIII. Ricochet butts are to be abolished. A "ricochet" can be distinguished in the marker's butt by the sound it makes when passing through the air, and by the mark made on the target. The "marker" will therefore, in future, be held responsible that all ricochets are signalled in the usual way with the red or "danger" flag.

IX. The direction of misses may be shown by special signal, instructions for which will shortly be published, and printed in a separate sheet for insertion in the Rifle Exercises and Musketry Instruction; and commanding officers will be held responsible that these instructions are strictly adhered to, more especially as to the marker not leaving his butt for this purpose.

X. The use of dummy targets, whereon to indicate the exact position of the hits on the target, is also sanctioned. The instructions in connection therewith are embodied in those for signalling misses.

XI. In consequence of the flat trajectory of the Martini-Henry rifle, judging distance practice for the drilled soldier will commence at 200 yards, and the following changes in the practice will take place:—

| Period. | Distance. | No. of Answers in a Period. | Value of Answer. | Points to be obtained to pass into a Higher Class. |
|---|---|---|---|---|
| 1st period, 3rd class .. .. | Between 200 and 500 yards .. | 8 | Within 15 yards, 2 points; within 30 yards, 1 point.. | 10 |
| 2nd period, 2nd class .. | Between 500 and 900 yards .. | 8 | Within 30 yards, 2 points; within 40 yards, 1 point.. | 10 |
| 3rd period, 1st class .. .. | Between 200 and 900 yards .. | 8 | Four distances at least to be over 500 yards. | |

XII. No classification will take place until the end of the 2nd period.

These alterations will take effect from the commencement of the annual course for 1876–77, and the Rifle Exercises and Musketry Instructions will be altered in accordance therewith.

### DIAGRAMS.

*Two Targets.*

| | |
|---|---|
| Bull's-eye .. .. | 1 foot diameter. |
| Centre .. .. | 9 feet diameter. |
| Outer .. .. | Remainder of target. |

*Third Class.*

Drilled Soldiers.

| | |
|---|---|
| 200 yards, standing | 10 rounds at each distance. |
| 300 „ kneeling | |

Recruits.

| | |
|---|---|
| 100 yards, standing | 5 rounds at each distance. |
| 150 „ „ | |
| 200 „ „ | |
| 250 „ „ | |

*Three Targets.*

| | |
|---|---|
| Bull's-eye . . | 2 feet diameter. |
| Centre . . | 4 feet diameter. |
| Outer . . | Remainder of target. |

*Second Class.*

Drilled Soldiers.

| | |
|---|---|
| 500 yards | 10 rounds at each distance; any position. |
| 600 „ | |

Recruits.

| | |
|---|---|
| 300 yards, kneeling | 5 rounds at each distance. |
| 350 „ „ | |
| 400 „ „ | |
| 450 „ „ | |

*Four Targets.*

| | |
|---|---|
| Bull's-eye . . | 3 feet diameter. |
| Centre . . | 5 feet diameter. |
| Outer . . | Remainder of target. |

*First Class.*

Drilled Soldiers.

| | |
|---|---|
| 700 yards | 10 rounds at each distance; any position. |
| 800 „ | |

Recruits.

| | |
|---|---|
| 500 yards | 5 rounds at each distance; any position. |
| 550 „ | |
| 600 „ | |
| 650 „ | |

*One Target.*

Black mark across the centre 2 feet square.

*Skirmishing.*

Drilled Soldier and Recruit.

10 rounds advancing and retiring between 400 and 200 yards; any position.

## N.

**Non-Commissioned Officer**—Includes an acting N. C. O., an army schoolmaster, and a warrant officer, not holding an honorary commission.

## O.

**Officer**—Beside the definition given in the Dictionary under this head, there should be added "a person whether retired or not, who, by virtue of his commission or otherwise, is legally entitled to the style and rank of an officer of H.M.'s forces, or of any arm, branch, or part thereof." Warrant and other officers holding honorary commissions, are officers within the meaning of the Army Act of 1881.

**Ordnance Select Committee**—Has been replaced by district committees on all subjects of importance, such as "explosives," "heavy guns," "proportions of ordnance," "wads or gas checks," &c.

**Outfit Allowance** — A non-commissioned officer granted a commission on appointment to a horse brigade of the Royal Artillery is allowed the same outfit allowance as a cavalry non-commissioned officer granted a commission, viz., £150. The allowance is also applicable to a garrison appointment which necessitates a horse being kept up. Riding masters of artillery will only be allowed £100. A schoolmaster promoted to be sub-inspector of army schools is allowed £100 in aid of his outfit.

## P.

**Palliasse** — A soldier's canvas mattrass. When required for use, it is filled from one end and is fitted with a flap, which forms a double border, and with eight tying strings to secure the straw from coming out.

**Passage Warrant**—The provisions of this warrant, which is inserted under the head of Appendix N. in the Dictionary, have been somewhat amended, and will be found in A.C. of November, 1878, clause 185. Army Regulations also give instructions on the subject.

The weight of baggage allowed by the new regulations is the same as in the appendix for staff and departmental as well as for regimental officers, but the following proviso is made:—"Upon embarkation for India the allowance of baggage of colonels and lieutenant-colonels will be reduced by 2 cwt., and that of majors by 1 cwt."

The quantity of baggage allowed for officers includes the following estimated weight of furniture:—

| STAFF. | Cwt. |
|---|---|
| Colonel and lieutenant-colonel | 10 |
| Major ... ... ... ... ... ... | 8 |
| Junior ranks ... ... ... ... ... | 5 |

| REGIMENTAL. | |
|---|---|
| Colonel ... ... ... ... ... ... | 10 |
| Lieutenant-colonel and major | 8 |
| Junior ranks ... ... ... ... ... | 5 |

In those cases in which particular reasons may render the conveyance of an officer's furniture unnecessary, the weight of baggage for which he will be allowed conveyance will be reduced accordingly.

Par. 5 in the new regulations is not included in Appendix N. It is as follows:

The officer commanding a battalion of the foot guards, if a field officer, will be permitted to carry the weight allowed for a lieutenant-colonel of a line regiment, and the captains, if lieutenant-colonels, the weight allowed for a major of the line.

To par. 2 of the appendix should be added after "medical officers" and "chaplains to the forces"; and after "2 cwt." next line, "veterinary surgeons and sub-inspectors of schools"; "and superintending schoolmaster" expunged.

To par. 11 after the word "company," "but soldiers moving in this country, though allowed the benefit of this additional baggage, will have no claim to its conveyance at the public expense when other means of transport are employed."

(For the rest of the regulations, *vide* warrant.)

**Pay, Deferred**—To be £3 per annum instead of 2*d*. per diem. Interests on sums accrued no longer allowed. Deferred pay granted to sergeants during the second period of engagement, subsequent to the 1st July, 1881, instead of ceasing, as now, at the completion of twelve years' service. For information on the subject of the above nature of pay, *vide* Revised Army Regulations for 1881, from Article 642–653.

**Pebble Powder**—Since the introduction of the first pebble powder a modification of the article as originally manufactured has taken place. The new powder contains slightly different conditions in regard to analytical, hygrometric, and velocity tests; and also as to the size, shape, and density of grain. In shape the lumps are cubical, with rounded edges, and number about 8 to the lb. It is designated P$^2$; density 1·75. It is used with heavy rifled ordnance. Experiments have been made lately with a powder known as "prism," which have shown that it is admirably adapted for increasing the penetrating power of certain of the heavier guns, and it has been resolved to apply it to that purpose. The new gunpowder consists of hexagonal prisms, nearly 1in. high by a little more than 1 1-3in. across, or specifically 0·976in. high and 1·367in. diameter over the angles, each prism having a circular axial perforation 0·394in. in diameter, the object of the perforation being to admit the whole of the powder to be exposed to the flame, and thus ensure perfect and equal combustion.

**Pension**—For the pensions and classification of pensions of N.C.O. and men of the army, *vide* warrants September 6, 1876, October 1, 1876, and clause 114 of A.C. August 1, 1877, also Revised Army Regulations, 1881, vol. 1.

**Pension, Indian**—The following are the latest pension rules for the Indian Army, and which took effect from July 1, 1881. The *Gazette of India* states that, for the purpose of these pension rules, which will be known as those of 1881, officers will be divided into four classes, viz.:—

I. Officers who entered the Staff Corps prior to or on Sept. 12, 1866.

II. Officers of the late Indian Cavalry and Infantry who have not joined the Staff Corps, commonly known as officers of the Local Service.

III. Officers on the General List, who entered the service under "new conditions of appointment," and who have not subsequently joined the Staff Corps.

IV. Officers who have entered the Staff Corps since Sept. 12, 1866.

3. The pensions for Classes I. and II. will be—

| | | |
|---|---|---|
| After 20 years' service | £288 | pension. |
| ,, 24 ,, | 420 | ,, |
| ,, 28 ,, | 571 | ,, |
| ,, 32 ,, | 783 | ,, |

4. The existing regulation which gives to these classes certain rates of pension after 35 years' and 38 years' service will thus become inoperative.

5. The conditions of retirement offered in G.G.O. No. 1 of Jan. 1, 1881, will not be renewed.

6. The pensions for officers in Classes III. and IV. will be—

| | | |
|---|---|---|
| After 20 years' service | £250 | pension. |
| ,, 24 ,, | 365 | ,, |
| ,, 28 ,, | 500 | ,, |
| ,, 32 ,, | 700 | ,, |
| ,, 38 ,, (as now) | 750 | ,, |

7. Furlough service for pension will continue to be governed by the furlough regulations under which each officer may be serving.

8. The senior officers of Classes III. and

IV. will succeed to colonel's allowances as soon as they have completed twelve years as substantive lieut.-colonel, until the number of officers in receipt of the allowances is equal to one-thirtieth of the whole of the officers in their respective lists in each Presidency, and thenceforward the number of colonel's allowances then enjoyed by officers of that class shall be considered as the fixed establishment to which officers are to succeed by seniority as vacancies arise. For the purposes of this scheme all the officers of Class III. of all three Presidencies will be placed on one list. The establishment will be ascertained by the number of officers remaining on that amalgamated list on the day the senior officer completes 12 years' service as substantive lieut.-colonel.

9. No colonel's allowances will be granted to any officer joining the Staff Corps as a probationer after July 1, 1881.

10. Pension regulations for officers entering the Staff Corps henceforward will be notified hereafter.

11. Officers will be allowed to commute a portion, not exceeding one-third, of their pensions, and this commutation may take place at any time, and not merely on retirement.

12. In every case the capitalised sum will be payable in rupees in India, the sterling sum being converted at the official rate of exchange for the year in which the payment is made.

13. Full power is reserved to the Secretary of State for India to temporarily suspend or limit retirement, whenever it may appear to him necessary in the interests of the public service to do so.

### VETERINARY DEPARTMENT.

Under the authority of the Secretary of State for India, H.E. the Governor-General in Council is pleased to notify that the following will be the scale of pensions for the officers of the Indian Veterinary Department:—

| | |
|---|---|
| After 25 years' service, including 3 years' furlough or leave of absence . . . . . | £350 |
| After 30 years' service, including 4 years' furlough or leave of absence . . . . | 450 |

2. The commutation of a portion of the pension not exceeding one-third, as sanctioned for combatant officers, will be allowed under the same conditions to officers of the Veterinary Department, such commutation being allowed to take place at any time, and not merely on retirement.

3. In every case the capitalised sum will be payable in rupees in India, the sterling sum being converted at the official rate of exchange for the year in which the payment is made.

4. The new scale of pensions will have effect from July 1, 1881.

**Pensions**—To be granted to all soldiers in the British Army who have served for twenty-one years from date of enlistment.

**Pipe-box**—Phosphor-bronze is used for the pipe-boxes of siege and field wheels which have had hitherto pipes of ordinary bronze.

**Pistols**—With reference to G. O. 16, of 1877, on the subject of revolver pistols, it is to be understood that, although Adams' revolver is the service pattern, officers who may provide themselves with revolvers of other makers will be in a position to obtain service ammunition from the stores of an army in the field, as well as those who procure Adams' revolver, provided the pistols are suitable for the 0·45 inch calibre service cartridge. Adams' revolver pistol is supplied to cavalry in place of the M.L. rifled pistol.

**Police, Military** — Mounted police employed at the various stations are not in future to be borne on the establishment of the cavalry regiments from which they are drawn, but will be formed into a separate corps, which will be referred to in all official documents as the corps of mounted police. The corps numbers 8 non-commissioned officers and 67 men.

**Pontoon Boat**—The present pontoon boat has undergone certain modifications in the mode of construction and fitment. *Vide* list of changes in war matériel, June, 1877.

**Promotion**—For the rules which regulate the promotion of officers, *vide* Revised Army Regulations for 1881.

**Promotion, Army**, *vide* royal warrant, August 13, 1877, and clause 53, A.C. April 1, 1878, also royal warrant, 1st July, 1881.

## R.

**Range-finder**—An instrument bearing this name has been introduced into the service for elevated batteries, as well as for field guns.

**Rank, Honorary** — Granted whilst serving, to a lieut.-colonel, or major, or captain, after a certain period of service in each grade, viz.: to the former after twenty-five years' service, and twenty years to the latter and to surgeons on retirement. This rule applies to all commissioned officers in the army, royal navy, royal marines, and the auxiliary forces.

**Rations**—The war ration has been slightly altered to what is laid down in the Dictionary. In the event of spirits being issued ¼ gill is the quantity. The scale of rations at home and at foreign stations differs also slightly.

**Re-engagement**—Explained in Dictionary, but the terms have been altered. The present Army Act reads thus: "Subject to any general or special regulations from time to time made by a Secretary of State, a soldier of the regular forces of an army service, and within three years of the completion of his original term of enlistment, may, on the recommendation of the commanding officer, and with the approval of the competent military authority. be re-engaged for such further period of army service as will make up a total continuous period of twenty-one years of army service, reckoned from the date of his attestation, and inclusive of any period previously served in the reserve." The above is subject to certain instructions, as shewn in the Queen's Regulations.

**Re-engagement of Soldiers** — Men who have been discharged from the army, may be permitted to re-enlist up to the age of 28 under certain circumstances, as shewn in Queen's Regulations.

**Regiment, Infantry**—Consists under the new Army Regulations of four battalions—two of the line and two militia. In many of the new territorial regiments, the fourth battalion has not yet been raised. Rifle regiments have more than four battalions.

**Regimental**—Means connected with a corps, or with any battalion, or other sub-division of a corps.

**Reserve Forces**—Means the army reserve force and the militia reserve force as established under the Reserve Force Act, 1867.

**Reserve, Supplemental**—Men enrolled in the 1st class of the army reserve, under the condition that they are not to be called out for permanent service, until the whole of the remainder of the said 1st class have been called out for permanent service.

**Retirement, Army,** *vide* royal warrant, August 13, 1877; clause 171, A.C. November 1, 1877; clause 53, A.C. April 1, 1878, and Revised Army Regulations 1881. Vol. 1.

**Revolvers,** *vide* pistols. The charge is 13 grains of Adams' pistol powder.

**Rifling**—The polygrooved system is gaining its way in the opinion of artillerists for ordnance.

**Rocket, War, Hale, 24-pr.**—A new pattern rocket of this nature was introduced shortly after the Dictionary was published. It differs from the previous pattern as follows, viz.:—"The iron case is cylindrical without any corrugations; it is fixed to the head and base piece by stronger rivets and screws, of which there are ten of each instead of eight; the interior, instead of being painted, is roughened, and then lined with a case made of four turns of brown paper and one turn of calico coated with shellac. The lining is tightly pressed in and burnished before filling in the composition. The paper discs over the vents are discontinued, and the interior of the rocket is protected by a piece of painted canvas covered over the whole of the tail-piece. This canvas is secured by a wrapping of twine round the base end of the rocket; the end of the tail-piece is previously covered by a piece of leather to prevent the sharp edges cutting through the canvas cover."

N.B.—"The twine must be cut, and the canvas and leather removed before firing.

It differs from the previous pattern, in the following particulars, viz.:—

The head is made of ebonite instead of wood.

The primer is fitted with two wires of platinum, 28 W.G., instead of copper, 24 W.G., and the ends of the wires are flush with the sulphur pillar, and are connected by a streak of black lead.

The conducting wires are insulated with vulcanised india-rubber instead of gutta-percha.

The tin tube is 1·35 inch in length, instead of 1·7 inch.

It is painted similarly to Mark I., *vide* changes in war *matériel*, but may be distinguished from it by having a shorter tin tube, and by the conducting wires being covered with india-rubber."

## S.

**Salute**—Her Majesty the Queen as Empress of India is saluted in India with 101 guns; the viceroy and governor-general of India with 31 guns.

**Salutes**—To be given by soldiers to officers of the civil department of the army.

**Scouts**—In a memorandum on "drill" issued to the army a few years ago, the duties of scouts or scouting are explained as follows:—

"A distinction must be drawn between scouting to report on ground and scouting for information. In scouting for information, a fourth of the scouts usually sent out would, as a rule, suffice, if they knew their work. In open ground they may be as much as 1,000 yards apart. When scouts come to open ground they should push forward rapidly to the front, and widely to the flanks until touch is gained of the enemy. The parties immediately furnishing the scouts should follow the latter at supporting distance. When the enemy's scouts are met with, they must be driven in, if possible, with a view to seeing what is going on behind them. This would be done either by reinforcing the line of scouts by the party in support, or by breaking through some part of the enemy's line with this party united, and attacking the enemy's support at once. If the enemy's scouting party is in superior force, then the scouts would, if possible, hold their ground, to continue watching the enemy's movements, and prevent him from discovering the force and movements on their own side. If pressed back, they should retire slowly, until their own infantry arrives within range of the enemy's scouts, when, their work being now over, they should, at once, rapidly clear the front all together. The business of the scouting party being to obtain and send back information, an immediate report should be despatched on coming in contact with the enemy. Frequent reports of any changes in the enemy's force and movements should follow as long as scouts remain out. The officer in command of the scouting party is responsible for the correctness of the reports sent back. Each report should, therefore, contain not only the fact of the enemy being in front, but as much information as can be ascertained as to his different arms, strength of force, and general direction of his movements. Scouts should be sent out in pairs, so that the enemy may be still watched while one man brings back information. Before sending out his scouts the commander of the party should give clear instructions to each scout as to what he should report, and where he should bring his report to.

In like manner, a clear understanding should exist between the commander of the scouting party and the commander of the whole force (when the force is small, as here supposed) as to the exact point to where reports from the fronts should be sent; and if the commander should have to leave this locality, a staff or other officer should be posted there to receive these reports and forward them at once. These latter points are of extreme importance, as messengers from the front are constantly seen galloping in the wildest way over the field in quest of a commander without any clue to his whereabouts. Much time (of extreme importance at this stage, when information is so essential) is hereby lost, and horses are unnecessarily overworked. As a general rule, when two opposing lines of scouts approach each other, that side which can show the strongest party in immediate support, can claim that the other side fall back. If the parties in immediate support on each side are equal, both are entitled to hold their ground. If the superiority on one side be not equal to two to one, then the weaker side may fall back at a walk. If equal to two to one, the weaker side must fall back at a trot. This matter of scouting is one that requires close supervision, as, if badly performed, it is worse than useless, for it does harm in proportion to the false sense of security it affords the main body. In most parts of Great Britain, nearly every road is, from the nature of the adjoining country, itself a defile; and all cultivated grounds abound in plantations. Practice in the defence and attack of defiles and small woods would, therefore, seem a very useful exercise for our troops."

**Seconded**—Defined in the Dictionary, but since then the rules on the subject have undergone a change. As stated in the Revised Army Regulations an officer will be seconded:—(1) On joining the Advanced Class of officers of the Royal Artillery. (2) On being appointed to the General, Personal, or Educational Staff, or to an adjutantcy in the Auxiliary Forces (other than the infantry militia.)

He may also under other circumstances be seconded.

An officer after he has been seconded for five years in a civil situation, shall, with the approval of the Secretary of State, have this limit extended for a further period of five years.—*Vide* R. W., 1st July, 1881.

**Servant's Allowance to Military Officers**, *vide* A.C. of November 1878, clause 183.

**Service Abroad**—In the future the tour nominally of a regiment will comprise about sixteen years. Officers and men will, however, not be actually more than eight years in India, being mainly relieved by drafts.

**Siege Train**—On the subject of artillery trains, light and heavy, the following has been decided upon:—"For administrative purposes the train will be formed into units, some of light and others of heavy rifled artillery. Each unit of the light siege train will comprise 30 guns, viz. ten 40-prs., ten 25-prs., and ten 6·3-inch howitzers. Each unit of heavy siege train will also consist of 30 guns, of which number 14 will be 8-inch howitzers, and the remaining 16 40-pr. and 64-pr. guns—8 of each nature. With each of the above units will be associated six 7-pr. field-guns of 200 lbs. (the lightest guns in the service being intended as mountain train guns), and 300 24-pr. Hale's rockets. Mortars, which have become almost practically obsolete, have been superseded in the siege train equipment by rifled howitzers."

**Sling Bridge**—This nature of bridge, known as the "single sling bridge," was formerly called the "single truss bridge."

**Solar Telegraphy**, *vide* Heliostat, in the Dictionary. The following interesting subject on solar telegraphy, taken from the *Times* a few years ago, is herewith reprinted:—

"It is a matter of common observation that the rays of the sun are brilliantly reflected to enormous distances from glass buildings or from polished surfaces. Take, for instance, the Crystal Palace as a familiar illustration; the sun's rays, falling upon the ridged roof at a suitable angle, are reflected many miles away, and are clearly visible even when the building is only dimly discernible through miles of intervening smoky atmosphere. Considering this, it might appear somewhat remarkable that advantage has not been taken of the circumstance to found a system of telegraphy thereon. Not that such a system could always be relied upon for use in this and other climates where sunlight is capricious. But in countries where sunshine is not so fitful such a system would serve the most useful purposes. As a matter of fact, the rays of the sun have been utilised for signalling purposes at intervals for centuries past. The fleet of Alexander the

Great is said to have been guided along the Persian Gulf by mirrors on his return from invading India. On the North American prairies, too, the Indians still carry on signalling by means of sun-flashes, and a similar method was adopted by the Russians at the siege of Sebastopol. But the principle appears never to have been reduced to a system; arbitrary signs have been and still are used; and no attempt seems to have been hitherto made to work out a perfect code of signals and to devise an instrument or apparatus which shall represent them.

Sun-flashing has, however, been of essential service in our Ordnance Survey, although even there it was only made to convey very limited information — to signal only, in fact, and not to converse. Towards the close of the last century General Roy was engaged in connecting the meridians of Paris and Greenwich, and he employed sun-flashing in his operations. Later on, in the early years of our Trigonometrical Survey, Bengal lights or Argand lamps were burned at night on the distant points the bearings of which it was desired to take. But this gave a very limited range and involved other practical difficulties, which led to the invention by Captain Drummond, R.E., of the light which bears his name. This enabled ranges of from 30 to 40 miles to be obtained, but even these distances were soon exceeded when, in 1822, Colonel Colby, R.E., who was then in charge of the survey, designed an apparatus for signalling by flashing the sun's rays, which proved very successful. Subsequently Captain Drummond improved upon Colonel Colby's instrument by the invention known as the heliostat, which was an instrument consisting of an adjustable mirror as a reflector, worked in connection with a combination of telescopes. This apparatus, at first somewhat complex, was afterwards greatly simplified. Professor Gauss, who was at this time conducting the survey of Hanover, also introduced a similar instrument, which proved of great service in facilitating the work. The heliostat is now a recognised adjunct of all trigonometrical surveys, and by its aid triangles having sides over 100 miles in length have been formed even in Great Britain—notably that formed by Sea Fell in Cumberland, Slieve Donard in Ireland, and Snowdon in Wales, the sides of which are respectively 111, 108, and 102 miles in length.

But the heliostat does no more than permit of an arbitrary set of signals being exchanged; it does not allow a conversation to be carried on. To bring the beams of the sun into subjection in this respect, and to utilise them as a means of freely interchanging ideas, was left for Mr. Henry C. Mance, of the Government Persian Gulf Telegraph Department, to accomplish. This he has succeeded in effecting by means of a very simple apparatus, which is known as the Mance Heliograph, or sun-telegraph, the construction of which we have lately had an opportunity of examining at the chambers of Mr. S. Goode, 5, Gray's-inn Square, that gentleman representing Mr. Mance in this country. The heliograph consists in the first place of a light tripod stand about 4 ft. long when folded up for transport. On this tripod is screwed a circular mirror, varying in diameter according to the purpose for which the instrument is designed; that is, whether for field or fixed observations. If for the former purpose, the mirror is about 4 in. in diameter; while if for the latter, it is about 9 inches. The mirror is hung in a frame so as to revolve about a horizontal axis, and it is adjusted to the required angle of incidence with the sun by means of a telescopic connecting-rod having a screw adjustment, the top end being attached to the upper edge of the mirror at the back. The horizontal circular traverse of the instrument is obtained by means of a tangent screw gearing into a small horizontal worm-wheel, with the centre of which the mirror is connected. By means of the tangent screw and the vertical screwed rod the rays of the sun can be made to fall upon any given point with the utmost precision. The vertical rod behind the mirror is pivoted at the bottom to a lever, the fulcrum of which is on the horizontal worm-wheel, the lever constantly pressing against the lower end of the rod by means of a spring which is placed under it. It will thus be seen that when the rod is depressed it will depress the top edge of the mirror and draw it slightly backwards, the bottom edge being at the same time slightly raised and thrown forwards. In adjusting the instrument to commence signalling the rays are directed to a point slightly below the distant observer's level, but upon depressing the connecting rod—for which purpose there is a small finger-piece attached to it—the flash is raised to the level of the observer, and he sees it. If, now, the lengths of these flashes be varied and grouped, they can be made to represent letters, and so words composing messages can be spelt out. This is precisely what Mr. Mance has done, and by adopting the Morse system of dashes and dots he is able on a fine day to make himself understood by an observer many miles off as easily as one electric telegraph operator makes himself intelligible to another.

In adjusting the instrument for use a light wooden rod having two brass sliding sights upon it is employed. This is set up in the ground in front of the instrument, and the operator looks through a small space in the centre of the mirror, from which the quicksilver has been removed, towards the station with which he desires to communicate. The upper sight on the rod is then moved vertically until the centre of the mirror, the sight, and the distant station are truly aligned. Hence when the flash from the mirror is directed on to the sight it is in true line with the distant station, and can be seen by the observer there. This will, of course, be whenever the angle of the mirror is raised; when depressed, or in its normal position, the flash rests upon a cross-piece on the rod, and, according as the sun's horizontal and vertical motions cause the flash to deviate from the true line, the signaller is able to see and to correct the error by means of the adjustments on the instrument. The observer at the distant station having seen the bright star-like appearances, sets his instrument to the point at which they appear and acknowledges the fact, and the parties being thus placed in communication, the interchange of messages proceeds upon the system we have mentioned—namely, the Morse alphabet.

There are other details to which it is not necessary to refer here, further than to observe that they consist in arrangements for signalling with the sun behind the apparatus by means of a reflector; for signalling at night, and for signalling either from fixed or variable positions. It is, however, an important fact that the apparatus has been in use for some time in India, where its working has been attended with every success, the range of the signals being very great and their intelligibility absolute. Official reports are very explicit in both these respects, and fully establish the capabilities of the heliograph. They state that the signals given are perfectly clear and satisfactory, and that they can be easily read in ordinary weather without telescopes up to 50 miles. Captain Collette, D.A.Q.M.G., certifies that under favourable conditions messages can be signalled up to 80 or even 100 miles without recourse being had to telescopes. The heliograph has the recommendations of economy in first cost and portability, as it weighs complete about 5 lb., and packs up into a very small compass.

Subsequently to examining into the construction of the heliograph we were afforded an opportunity of witnessing its practical working by Mr. Goode. Taking advantage of the sunshine on Monday afternoon, Mr. Goode stationed himself on the dome of St. Paul's, having previously despatched an electric telegraph operator to the Crystal Palace, where he stationed himself with a heliograph in the gallery of the North Tower. Mr. Goode had a telegraphic operator with him, and there was also present Mr. Sanders, of the Eastern Telegraph Company, who are arranging for the application of the system from Gibraltar across the Straits to Ceuta, in Morocco, thus bringing that country into telegraphic communication with Europe. The weather was not very propitious, the sky being at times overcast, while during the operations a heavy storm-cloud was observed to drift over Sydenham. The two operators, moreover, had not previously seen the apparatus and made no arrangement previously to setting to work as to their course of procedure. Nevertheless, the instruments were duly sighted, and a series of brilliant flashes of light from the Palace tower indicated that those from St. Paul's had been seen. Signals in long and short flashes were freely interchanged as the intervals of sunshine permitted, but for reasons stated conversation was not entered upon. In other words, the operators signalled rapidly and readily, but they did not talk, as they might have done by preconcerted arrangement. Sufficient, however, was effected to demonstrate that, given an unclouded sun, the heliograph is a very efficient telegraphic instrument.

The uses to which the heliograph may be applied are very numerous, although it is not pretended that they are numberless. In military operations especially it would prove invaluable; if, for instance, the system had been in use by the French army during the siege of Metz, Marshal Bazaine could have communicated with the forces which were operating for his relief without hindrance, and in all probability France would not have experienced the disaster of Sedan. Looking at our Indian possessions, should another mutiny occur there, lines of telegraph wires would, of course, be cut and railways destroyed. At such a juncture the heliograph would prove invaluable by maintaining communication between distant points. By its means, too, a detached force operating in hill districts could be connected with the main body of troops, or two forces like Wolseley's and Glover's in the late Ashantee war could be thus united and enabled to operate in concert. For reconnoitring, flanking and reconaissance parties also it would prove highly advantageous; it would not matter, so far as the operations were concerned, if a reconnaissance party were captured, because, unless surprised, they would have previously flashed their information back to the main army. It is not intended that the heliograph should supersede flag-signalling, although in many cases it might be used with advantage in the place of flags, which are invisible at long ranges unless they can be displayed on the horizon. In fact, just at the point where flags fail the heliograph becomes useful.

The applications of the heliograph to civil purposes are not less numerous than those to military use. It would serve as a substitute for wires in countries where the electric telegraph would not pay, and where trunk lines existed they could be fed by the heliograph, which would effect communication with the outlying districts. It could be used for temporary purposes on special occasions inland, while there are countries on the coasts of which it might be substituted for expensive submarine cables. In the event, too, of short submarine cables failing, as they often do, it could be used for maintaining communication, provided the weather permitted. In short, the heliograph would appear to be an admirable adjunct to the electric telegraph in all countries, while in some it would supersede it with advantage. It is, as we have previously observed, already in use in India, and we are informed that our own Government, as well as several foreign Powers are investigating its merits with a view to its adoption." During the late campaign in Affghanistan, Solar Telegraphy was much resorted to, and its use proved invaluable.

**Soldier** — This expression does not include an officer as defined by the Army Act of 1881, but, with the modifications in the Act, contained in relation to warrant and non-commissioned officers, does include a warrant officer not having an honorary commission, and a non-commissioned officer, and every person subject to military law, during the time that he is so subject.

**Staff**—A change has been made in the regulations as regards staff employment, whereby officers of regiments on the home establishment are permitted to take up staff appointments in India and in the colonies, and in the case of regiments returning home from abroad to retain their appointments during the regulated period, if seconded or permitted to retain the appointment by special authority.

**Stock**—Government property, such as stores, composing the contents of an arsenal or any other department. A combatant officer appointed to "take stock," either at home or abroad, is entitled to receive extra pay of 5s. a day.

**Studs**—Under this head in the Dictionary it is shewn that studs are fastened to most projectiles in the service, and the reason for so doing is given; but there is a very general impression among artillerists that studs are not necessary to rotate the projectile, as this can be obtained now by discs of soft metal attached to the rear of the shot, in other words, a gas check, which, by expanding so as to fit the bore and fill up the grooves, not only prevents the escape of gas, but gives the projectile the necessary rotation on its axis. The form of the rifling and number of grooves has yet to be decided, but practically studs are condemned, and the gas check eventually will be alone relied on to spin the shot, with the possible addition of a band of soft metal, such as copper, round the head and tail of the projectile to centre it steadily. To carry out the change, the twist of the gun must be an increasing one. The Italian 100-ton gun fires a perfectly smooth shot, the necessary rotatory motion being imparted to it by a disc of copper fastened to its base, which, being expanded by the force of the discharge, is set up into the grooves, which are many in number and of shallow depth. In the experiments made at Woolwich, the gas check, which is now attached to all projectiles, was made with the view of preventing an escape of powder gas over the shot, not to perform the double duty of preventing the escape of the powder gas and also of rotating the shot; but doubtless, in the future, advantage will be taken to combine both, and thus eventually to get rid of the studs, the disadvantages of which are apparent in the "wabbling" of the shot owing to the imperfect fit, in weakening the projectile, and to some extent impairing its power of penetration.

**Stretcher**—Weight, 1 qr. 3 lbs.

**Sub-Lieutenant**—This rank is abolished in the line, militia and volunteer service, and lieutenant substituted in all fresh appointments to the army.

**Summary Court-Martial**—When a person subject to military law and being on active service with any body of force is charged with an offence, a summary court-martial may be convened, and shall have jurisdiction to try such offence, if the officer convening the court is of opinion that an ordinary court martial cannot, having due regard to the public service, be convened to try such offence.

**Supernumerary**—Substitute as follows in lieu of what is stated in Dictionary.—An officer shall be retained as a supernumerary on the strength of the regiment or corps:—

(*a*) In case of a reduction in the establishment or corps, when his retention is authorised by the Secretary of State for War.

(*b*) While waiting a vacancy after retiring from the Seconded List..

## T.

**Telegraphy**—Under this head in the Dictionary omit 3rd line from the beginning of the subject "telegraphic"; 4th line for "two" read "three"; 5th line erase "and," and after "telegraph" insert "and by mounted orderlies."

**Territorial**—Literally, pertaining to territory or land. The name is now applied to the linked regiments of the British Army, composed of the line and militia, and taking their designation from the counties in which the line regiments to some extent recruit, and militia regiments are raised. A territoriai regiment is made up, as a rule, of 2 battalions of the line, and the same number of militia battalions.

**Training**—Commonly used to express the instruction and drill imparted periodically in militia regiments to officers and men. Young officers qualifying for the line have to pass two trainings before they are permitted to join a regiment of the line, and then only if they have passed the qualifying examination—*vide* A. C. 1st January, 1881, inserted under the head of "Commissions."

**Trestle**—What is known as the Aldershot pattern is designed to pack into a pontoon waggon.

## V.

**Vent Server**—Used with the undermentioned natures of ordnance:—

"All rifled M.L. guns and howitzers, from 25 pr. gun, inclusive, upwards."

"All smooth-bore garrison ordnance."

**Veterinary Department**—A new royal warrant having reference to this department, altering the terms and conditions of service, will be found in A.C. May 1878, clause 68. *Vide* also Queen's Regulations.

**Volunteers** — *Vide* Dictionary — Revised Regulations for this force have been approved.

PUBLISHED BY

## WILLIAM CLOWES & SONS, LIMITED,

13, CHARING CROSS, LONDON, S.W.

**An Arrangement of Battalion Drill,** for the Use of Officers attached to the School of Instruction for Officers of the Auxiliary and Reserve Forces, Wellington Barracks. By Lieut.-Col. H. STRACEY, late Commandant of the School. 2*s.*; post-free, 2*s.* 1*d.*

**Method of Instructing a Company Practically on Parade in Company** DRILL ON THE SYSTEM LAID DOWN IN THE 'FIELD EXERCISE,' 1877; adopted, for the sake of uniformity, at the School of Instruction at the Wellington Barracks for Officers of the Auxiliary and Reserve Forces. By Lieut. F. C. RICARDO, Grenadier Guards, Adjutant of the School. Fourth Edition. 1*s.*; post-free, 1*s.* 1*d.*

## BY T. CAMPBELL-COPELAND.

**The Color Serjeant's Pocket-Book.** Cloth, 1*s.* 6*d.*; post-free, 1*s.* 8*d.* Cloth, gilt, with pencil, 2*s.* 6*d.*; post-free, 2*s.* 8*d.*

"A marvellous compendium of useful facts and figures."

"Every officer and non-commissioned officer in the British Army should possess one of these extremely useful books."

**The Army Sheet Almanac for 1882.** 1*s.*; post-free, 1*s.* 1*d.*

Useful for all Mess Rooms, and of *especial* value to Officers and Senior Non-Commissioned Officers having separate quarters. The "Diary and Reminder," if regularly kept, will serve as a record of duties and engagements, Committees to be attended, &c., &c. A detail of the Regular Forces, giving Strengths, Stations, Honours, and Devices, corrected to date of issue, occupies a considerable portion of the Almanac.

**The Color Serjeant's Ledger.** 5*s.*; post-free, 5*s.* 6*d.*

To those who understand the nature of a Pay-Serjeant's work the utility of a book ready ruled, and prepared with headings for most of the different forms in use, will be apparent. A great deal of time, trouble, and annoyance will be saved by using the Ledger, as all other books of record may be dispensed with as superfluous. It may also be replaced whenever necessary.

## LIEUT. CHAS. SLACK'S WORKS.

**Tactical Blocks** (now ready), for practising all the Movements and Combinations of the Three Arms. Consist of a Battalion of Six Companies, One Squadron, Four Guns, with Brigade Staff, Section of Engineers, Supply, Ambulance, &c. Each Company, Troop, and Division of Guns complete, with Officers and Serjeants. Arranged for use on any Large Scale Map for Practising Tactics. Price, in Box complete, 22*s.*

**Handbook of Company Drill.** Also of Extended Order, Advancing by Rushes, Formation of Advanced and Rear Guards, Guard and Sentry Duties, Infantry Sword Exercise, &c. Illustrated by 60 Plates, which show every movement in Company Drill, with the Positions of the Officers, Serjeants, and Rank and File. 19th Edition. Post-free, 1*s.* 1*d.*

**Handbook of Battalion Drill,** Extended Order for Attack, Inspections, Encampments, Field Firing, and Army Signalling. 70 Plates. 10th Edition. Post-free, 2*s.* 1*d.*
(Bound with 'Handbook of Company Drill,' in one vol., post-free, 2*s.* 8*d.*)

**Handbook of Brigade Drill,** Inspections, Reviews, and Attack Formations. 40 Plates, with Formation of Double Companies for Marching Past. Post-free, 3*s.* 1*d.*
(Bound with 'Handbooks of Company and Battalion Drill,' in one vol., 5*s.* 8*d.*

**Catechism of Company Drill.** Squad Drill, Payment of Troops, Musketry Instruction, Guards and Sentries, with Detail of Officers' Field Kit and Equipment, Syllabus of Examinations for Lieutenants. 8th Edition. Illustrated. Post-free, 1*s.* 1*d.*

**Catechism of Battalion Drill,** Brigade Drill, Reviews, Infantry Outposts, Queen's Regulations, Regimental Duties, Military Law, Tactics, Reconnaissance, Transport of Troops by Railway, &c. Syllabus for Captains and Majors. Illustrated. Post-free, 2*s.* 7*d.*
(Bound with 'Catechism of Company Drill,' in one vol., post-free, 3*s.* 2*d.*)

**Handbook of Infantry Drill.** Handbooks and Catechisms. One vol., post free, 7*s.* 10*d.*

LONDON: WILLIAM CLOWES & SONS, LIMITED, 13, CHARING CROSS, S.W.

THE

# NEW DRILL MODEL APPARATUS,

## AWARDED THE PRIZE MEDAL
AT
## THE PARIS EXHIBITION, 1878.

---

**Wm. CLOWES & SONS, LIMITED, desire to call the special attention of Commanding Officers and others to their**

# NEW DRILL MODEL APPARATUS,

(PATENTED),

## FOR CAVALRY AND INFANTRY DRILLS,

RECENTLY INVENTED BY

## CAPTAIN E. PODMORE CLARK,

INSTRUCTOR OF MUSKETRY, HEREFORDSHIRE MILITIA, AND LATE LIEUT. 62ND REGIMENT.

THIS Apparatus, which has received the highest commendation from H.R.H. the Field-Marshal Commanding-in-Chief, and from the Heads of Departments at the War Office, offers peculiar facilities for giving practical instruction in Cavalry and Infantry Drills. The positions of Officers, Markers, etc., in all movements are clearly defined. The ranks can be *simultaneously* turned in any direction.

The MODEL is so perfect in all its details that it should readily find a place at the Head-Quarters of every Regiment, where it would prove invaluable, whether as a means of instruction, or of illustrating lectures, or conducting examinations in connection with the "Field Exercise and Evolutions of Infantry."

Wm. CLOWES AND SONS, LIMITED, will be happy to show the Apparatus to any officer who may care to inspect it, at their PUBLISHING OFFICE, 13, CHARING CROSS, S.W.

| | | | |
|---|---|---|---|
| CAVALRY APPARATUS (consisting of Eight Troops, with full complement of Officers, &c.) | £10 | 10 | 0 |
| INFANTRY APPARATUS (consisting of a Battalion of Six Companies, with mounted and other Officers, Colour Party, Band, Pioneers, &c.) | 5 | 5 | 0 |

Each Packed in a well-arranged Box, with lock and key, complete.

"There can be no doubt about its use to Officers."—*Times.*

3 2044 051 765 394

This book should be returned to the Library on or before the last date stamped below.

A fine is incurred by retaining it beyond the specified time.

Please return promptly.

WIDENER
CANCELLED
BOOK DUE
FEB 16 1981
MAR 3 1981
7032715

HARVARD COLLEGE
CONSERVED
1-2003
LIBRARY